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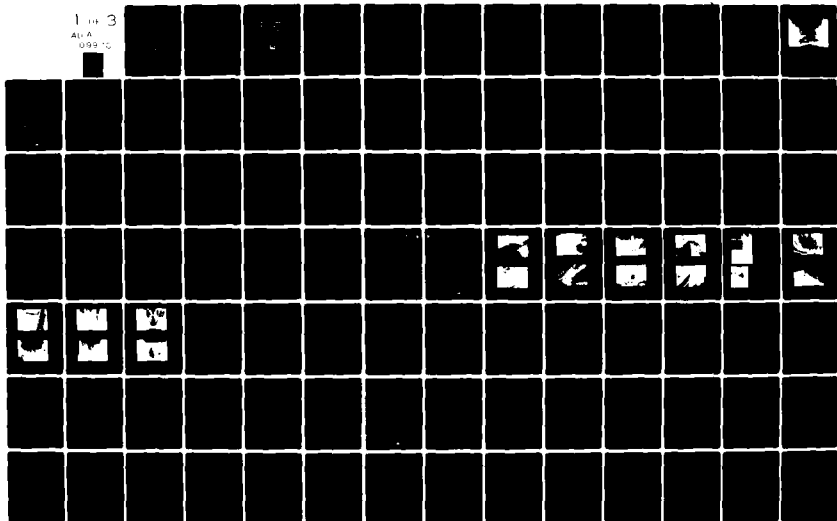
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NATIONAL DAM INSPECTION PROGRAM. BLACK CREEK RESERVOIR DAM (NY --ETC(U)  
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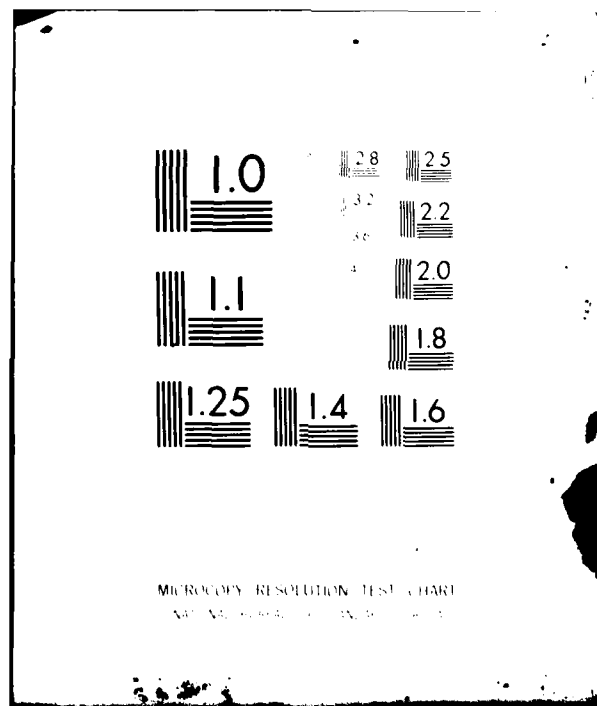
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REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER	2. GOVT ACCESSION NO.	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) Phase I Inspection Report Black Creek Reservoir Mohawk River Basin, Herkimer County, NY Inventory No. 182	AD A109970	5. TYPE OF REPORT & PERIOD COVERED Phase I Inspection Report National Dam Safety Program
6. AUTHOR(s) KENNETH J. MALE	7. CONTRACT OR GRANT NUMBER(s) DACW51-81-C-0014	8. PERFORMING ORG. REPORT NUMBER
9. PERFORMING ORGANIZATION NAME AND ADDRESS C.T. Male 3000 Troy Road Schenectady, New York 12309	10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS	11. REPORT DATE 14 September 1981
11. CONTROLLING OFFICE NAME AND ADDRESS Department of the Army 26 Federal Plaza New York District, CofE New York, New York 10287	12. NUMBER OF PAGES	13. SECURITY CLASS. (of this report)  UNCLASSIFIED
13. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office) Department of the Army 26 Federal Plaza New York District, CofE New York, NY 10287	14. DECLASSIFICATION/DOWNGRADING SCHEDULE	
15. DISTRIBUTION STATEMENT (of this Report)  Approved for public release; Distribution unlimited.		
17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)		
18. SUPPLEMENTARY NOTES		
19. KEY WORDS (Continue on reverse side if necessary and identify by block number) Dam Safety National Dam Safety Program Visual Inspection Hydrology, Structural Stability  Black Creek Reservoir Mohawk River Basin Herkimer County		
20. ABSTRACT (Continue on reverse side if necessary and identify by block number) This report provides information and analysis on the physical condition of the dam as of the report date. Information and analysis are based on visual inspection of the dam by the performing organization. >Examination of available documents and visual inspection of the dam did not reveal conditions which constitute an immediate hazard to human life or property. However, the dam has some serious deficiencies which require further investigation and remedial work.		

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cont → Hydrologic and hydraulic analysis indicated that maximum spillway discharge capacity is only about 21% of the PMF peak outflow. The 1/2 PMF would overtop the earth embankment and would probably cause failure. Therefore, in accordance with Corps of Engineers screening criteria for review of spillway adequacy, spillway capacity is considered "seriously inadequate" and the dam is assessed as "unsafe, non-emergency".

→ The classification of "unsafe" applied to a dam because of a seriously inadequate spillway is not meant to connote the same degree of emergency as would be associated with an "unsafe" classification applied for a structural deficiency. It does mean that there appears to be a serious deficiency in spillway capacity and if a severe storm were to occur, overtopping and failure of the dam could take place, significantly increasing the hazard to loss of life downstream of the dam.



**MOHAWK RIVER BASIN  
TOWN OF NORWAY  
HERKIMER COUNTY, NEW YORK**

**BLACK CREEK  
RESERVOIR DAM  
NY 00182**

**PHASE I INSPECTION REPORT  
NATIONAL DAM INSPECTION PROGRAM**



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**DEPARTMENT OF THE ARMY  
NEW YORK DISTRICT, CORPS OF ENGINEERS  
26 FEDERAL PLAZA  
NEW YORK, NY 10278**

**JULY 1981**

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## PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I Investigations. Copies of these guidelines may be obtained from the Office of Chief of Engineers, Washington, D.C. 20314. The purpose of a Phase I investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigation, and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I investigation; however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. In cases where the reservoir was lowered or drained prior to inspection, such action, while improving the stability and safety of the dam, removes the normal load on the structure and may obscure certain conditions which might otherwise be detectable if inspected under the normal operating environment of the structure.

It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through frequent inspections can unsafe conditions be detected and only through continued care and maintenance can these conditions be prevented or corrected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the Spillway Test Flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions thereof. Because of the magnitude and rarity of such a storm event, a finding that a spillway will not pass the test flood should not be interpreted as necessarily posing a highly inadequate condition. The test flood provides a measure of relative spillway capacity and serves as an aide in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.

The Phase I investigation does not include an assessment of the need for fences, gates, no-trespassing signs, repairs to existing fences and railings and other items which may be needed to minimize trespass and provide greater security for the facility and safety to the public. An evaluation of the project for compliance with OSHA rules and regulations is also excluded.

## BLACK CREEK RESERVOIR DAM, NY 00182

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## NATIONAL DAM INSPECTION PROGRAM

## PHASE I INSPECTION REPORT

Identification No.: NY 00162  
 Name of Dam: Black Creek Reservoir Dam  
 State Located: New York  
 County: Dutchess  
 Municipality: Town of Newburgh  
 Watershed: Dutchess River Basin  
 Stream: Black Creek  
 Date of Inspection: June 7, 1961

DESCRIPTION

Inspection of available documents and aerial inspection of the dam did not reveal complete information on immediate threat to human life or property. However, the dam has some serious deficiencies which require further investigation and remedial work.

Inspection and available available information did not indicate any likelihood of failure of the dam. The dam is a gravity dam and the 1/2 mile long earthen embankment and spillway probably cause failure. Therefore, it is recommended that a study of the dam be conducted to determine the extent of spillway damage, spillway capacity to withstand "extremely high water" and the dam to be considered as "unsafe, non-emergency".

The classification of "unsafe" applied to a dam because of a serious structural failure is not meant to indicate the same degree of emergency as would be associated with an "unsafe" classification applied to a structural failure. It does mean that there appears to be a serious deficiency in spillway capacity and if a severe storm were to occur, overflowing and failure of the dam could take place, significantly increasing the hazard to loss of life downstream of the dam.

Therefore, it is recommended that within 3 months after receipt of this report by the Owner, a detailed hydrologic and structural analysis be started to better assess spillway capacity. This should include a more accurate determination of the site specific characteristics of the watershed. Within 12 months after receipt of this report by the Owner, any necessary remedial work should be completed.

The detailed analysis and the design and construction observation of any remedial work should be done by a qualified, registered professional engineer.

In the meantime, the Owner should immediately institute a program to visually inspect the dam and its appurtenances at least once a month. Also, within 3 months after receipt of this report the Owner should complete development of a surveillance program for use during periods of heavy runoff and of an emergency action plan outlining action to be taken to minimize the downstream effects of an emergency, together with an effective warning system.

Structural stability analysis of the Anderson spillway section indicates that it is unstable for all loading conditions, including the normal spring-summer-fall condition and the added low load condition. Therefore, it is recommended that a detailed structural stability analysis of the Anderson spillway section under all loading conditions be effected within 3 months after receipt of this report by the Owner. This analysis should include appropriate field and laboratory work to determine actual foundation material properties and structural details, including concrete cross sections of the spillway. Any necessary remedial work should be completed within 12 months after receipt of this report by the Owner. The investigation and the design and construction observation of any remedial work should be done by a qualified, registered professional engineer.

Specific of other activities, the following suggested investigations should be effected within 3 months after receipt of this report by the Owner. The investigations should be performed by a qualified, registered professional engineer.

- 1) Investigate the connection of the spillway training walls at their heads with the abutments and the core wall, as well as the filling of the left training wall.
- 2) Investigate the erosion on the left bank of the downstream channel near the toe of the dam.
- 3) Investigate the soil, cut area on the channel bed near the downstream slope of the abutment and the right abutment.
- 4) Investigate the inside of the Anderson spillway section when the outlet pipes are closed.

Any remedial work deemed necessary as a result of these investigations should be completed within 12 months after receipt of this report by the Owner. A qualified, registered professional engineer should design and observe the construction of any necessary remedial work.

The following remedial work should be completed by the Owner within 12 months after his receipt of this report. Where engineering assistance is indicated, the Owner should engage a qualified, registered professional engineer. Assistance by such an engineer may also be useful for some of the other work.

- 1) Contingent on the results of the detailed hydrologic and hydraulic analysis, the detailed structural stability analysis, and other investigations recommended, repair the deteriorated concrete of the Amberson spillway section.
- 2) Remove trees and brush and their root systems from the embankment and from a 30-foot wide belt to the downstream toe in accordance with specifications and field observation of the work by an engineer. Backfilling the zones where stumps and roots have been removed should be done with proper material and procedures. Continue to keep these areas clear by cutting, mowing, and clean-up at least annually.
- 3) Provide erosion protection for the embankment in accordance with design and field observation of the work by an engineer.
- 4) Adjust the outlet pipe valves so that they operate more easily and perform regular maintenance.
- 5) Repair the deteriorated concrete apron downstream of the spillway.
- 6) Develop and implement effective routine operation and maintenance procedures for the dam and its appurtenances.
- 7) Institute a program of comprehensive technical inspection of the dam and its appurtenances by an engineer on a periodic basis of at least once every two years.



D. LIND SUTTON

Approved by:

Date:

*Kenneth J. Mole*  
 Kenneth J. Mole  
 President  
 C. T. Mole Associates, P.C.  
 NY PE 25004

*Carl V. M. Smith, Jr.*  
 Carl V. M. Smith, Jr.  
 New York District Engineer  
 Corps of Engineers

*14 Sept 81*



Overview Photo - Black Creek Reservoir Dam (spillway) - 6/3/81

**PROJECT NO. 88-01-008 / 80.840**

TOWN OF NORWAY	HERKIMER CO., NY
AREA 1" = 1.5 MILES	DATE JANUARY 1981

FORM NO. 10-67 (REV. 11-29-66)

## NATIONAL DAM INSPECTION PROGRAM

## PHASE I INSPECTION REPORT

NAME OF DAM: BLACK CREEK RESERVOIR DAM, ID NO. NY 00182

## SECTION 1

## PROJECT INFORMATION

1.1 GENERALa. Authority

The National Dam Inspection Act, Public Law 92-367, August 8, 1972, authorized the Secretary of the Army through the Corps of Engineers to initiate a national program of dam inspection throughout the United States. The New York District of the Corps of Engineers has been assigned the responsibility of supervising the inspection of dams within New York State. C. T. Male Associates, P.C., has been retained by the New York District to inspect and report on selected dams in the State of New York. Authorization and notice to proceed was issued to C. T. Male Associates, P.C., under a letter from Michael A. Jezior, LTC, Corps of Engineers. Contract No. DACW51-81-C-0014 has been assigned by the Corps of Engineers for this work.

b. Purpose of Inspection

The purpose of the inspection program is to perform technical inspection and evaluation of non-Federal dams to identify conditions which threaten the public, and thus permit correction in a timely manner by non-Federal interests.

1.2 DESCRIPTION OF PROJECTa. Location

The dam is located on Black Creek upstream of the Hinckley Reservoir, about one mile east of the hamlet of Gray. The dam at its maximum section is at Latitude 43 degrees - 15.3 minutes North, Longitude 74 degrees - 55.7 minutes West.

Access to the dam is from State Route 28 north to the Village of Poland, then via State Route 8 and Hurricane Road (County Route 8) east to the hamlet of Gray, and then southeast via Bull Hill Road (County Route 129) and Black Creek Road (County Route 147) to the dam (see Vicinity Map).

The official name of the dam is Black Creek Reservoir Dam and the official name of the impoundment is Black Creek Reservoir. The dam is popularly known as Gray Dam and in the past has been called Tracy Dam. The reservoir is also referred to as Gray Reservoir.

b. Dam and Appurtenances

Black Creek Reservoir Dam has an Ambursen-type spillway section with earthen embankments extending from the ends of the Ambursen structure to the abutments. The dam is about 385 feet long (including the spillway), about 35 feet high, and the earth portions are about 25 feet wide at the crest. Between the Ambursen structure and the left abutment the embankment section is about 85 feet long; between the Ambursen structure and the right abutment the embankment section is about 200 feet long. Both embankment sections have an upstream slope of about 2.5H:1V and are protected with riprap which is 12 to 18 inches in diameter. The downstream slopes of the embankment sections are about 2H:1V. The specifications for the dam call for a mixture of "selected clay and gravel" in the embankment upstream of a concrete core wall, and for gravel downstream of the core wall. A progress report on the construction of the dam, dated May 28, 1906 (see Appendix F3-19), makes reference to a foundation of "very fine, dense, clayey, sand completely interlarded with boulders of all sizes."

The dam has a 99-foot-long overflow spillway that consists of a reinforced concrete Ambursen section with 10 bays (9 buttresses), concrete training walls, a concrete upstream face, and a timber plank downstream face. A log sluice 8.6 feet wide by 6 feet high, stop-logged shut, is located near the right side of the spillway crest. At the downstream end of the spillway there is a concrete apron about 25 feet wide.

Inside the spillway section, in bays 3 to 6 (numbered from left to right looking downstream) there are four 24-inch-diameter cast iron outlet pipes from the reservoir which discharge underneath the spillway. The outlet pipe in bay 3 is controlled by one valve at its downstream end while the remaining outlet pipes are each controlled by two valves in series. Access to the valves is through a metal hatch on the downstream side of the spillway in bay 7.

61. c. Size Classification

In accordance with Recommended Guidelines (Reference 1), Black Creek Reservoir Dam is classified as "intermediate" in size because the maximum storage capacity at top of dam is 5,848 acre-feet (within the 1,000 to 50,000-acre-foot range). The height of the dam is about 35 feet.

d. Hazard Classification

In accordance with Recommended Guidelines (Reference 1), Black Creek Reservoir Dam is classified as having a "high" hazard

potential. This is because it is judged that failure of the dam would significantly increase flows downstream which could cause loss of more than a few human lives and appreciable property damage. Downstream development that could be damaged or destroyed by a dam failure includes: a road crossing (County Route 147) located about 300 feet downstream and several dwellings in the hamlet of Gray located about 1.5 miles downstream (vertical drop from the spillway crest to the stream next to the dwellings is about 60 feet).

e. Ownership

The dam was originally constructed in 1906 for the Consolidated Water Company, a private water utility. Presently the dam and reservoir are owned by:

City of Utica Board of Water Supply  
P.O. Box 345  
1 Kennedy Plaza  
Utica, New York 13502

Attn: Russell S. LoGalbo, P.E., Principal Engineer  
(315) 798-3316

f. Operator

The dam facilities are only operated twice a year, in the spring, by Water Department personnel from the City of Utica. The dam has a caretaker who lives near the dam and visits the dam daily. The caretaker is:

William Farber  
Gray, New York  
(315) 845-8299

g. Purpose of Dam

The dam is presently used for flood control of spring runoff and to supply compensation water to Hinckley Reservoir. The compensation water is to replace Hinckley Reservoir water used by the City of Utica water system.

h. Design and Construction History

The dam was constructed in 1906 for the Consolidated Water Company of Utica. The designer and construction contractor for the dam was the Ambursen Hydraulic Construction Company, no longer in business. Data concerning the original design and construction can be found in Appendices F2, F3, and G.

In the past, several of the outlet pipe valves have been replaced. The timber deck on the spillway has been replaced several times, the last time being in 1974. Also in 1974 concrete repairs to the downstream ends of the spillway buttresses were made. There is also evidence of concrete repair work to the spillway training walls.

There is no knowledge or record of other construction, modification, or major repair to the dam. Refer to Section 2 of this report, as well as to the Engineering Data Checklist in Appendix F2, for a complete discussion of the design and construction history. Selected drawings and other engineering data are included in Appendices F3 and G.

#### 1. Normal Operating Procedures

The caretaker visits the dam daily and records the water level. The water level is normally at or below the spillway crest, with the valves on all four outlet pipes normally partially open (5 turns open). In the spring of each year all four outlets are completely opened by Water Department personnel from the City of Utica and the reservoir is drained to provide more flood storage. The reservoir is then allowed to fill, and when the water level reaches the spillway crest the valves on the outlets are closed back to their normal position.

#### 1.3 PERTINENT DATA

a. <u>Drainage Area</u> (square miles)	23.99
b. <u>Discharge at Dam Site</u> (cfs)	
Spillway (W.S. at top of dam)	4,490
Outlet Pipes (normally partially open)	
- (one fully open w/W.S. at top of dam)	90
- (four fully open w/W.S. at spillway crest)	310
Spillway & One Outlet Pipe Fully Open (W.S. at top of dam)	4,600 ±
Maximum Known Flood (estimate based on 2.2 feet over spillway crest recorded on May 3, 1914)	1,000

#### c. Elevation (feet - NGVD)

All elevations are based on elevations found in a report titled "Gray Reservoir Capacities" by A.I. Lashure, L.S. (see Appendix F3-78) and are assumed to be in feet above mean sea level NGVD (National Geodetic Vertical Datum of 1929). The drawings of Appendix G were also useful in determining elevations. The elevation base of the drawings in Appendix G is 1220 feet lower than NGVD.

Top of Dam	1316
Design High Water	Unknown

- |    |  |        |
|----|--|--------|
|    | Spillway Crest   | 1310   |
|    | Entrance Inverts of Outlet Pipes   | 1283   |
| d. | <u>Reservoir Length</u> (feet) - at spillway crest   | 8000 ± |
| e. | <u>Reservoir Surface Area</u> (acres)  |        |
|    | Top of Dam   | 431.3  |
|    | Spillway Crest   | 322.7  |
| f. | <u>Reservoir Storage</u> (acre-feet)   |        |
|    | Top of Dam   | 5,848  |
|    | Spillway Crest   | 3,584  |
| g. | <u>Dam</u>   |        |
|    | Type - Ambursen structure, with earthen embankments between ends of Ambursen structure and abutments.  |        |
|    | Length - About 385 feet (includes spillway).   |        |
|    | Height - About 35 feet.  |        |
|    | Top Width - About 25 feet (earth portion).   |        |
|    | Side Slopes (embankment sections) - Upstream - About 2.5H:1V.  |        |
|    | - Downstream - About 2H:1V.  |        |
|    | Zoning (embankment sections) - Specifications call for mixture of "selected clay and gravel" upstream of core wall, and "gravel" downstream of core wall.                                |        |
|    | Impervious Core (embankment sections) - Concrete core wall extending from Ambursen structure about 200 feet toward the right abutment and about 85 feet toward the left abutment.        |        |
|    | Cutoff (embankment section) - Depth of core wall reported to be 4 to 12 feet below original ground surface.  |        |
|    | Cutoff (Ambursen section) - Drawing dated March 21, 1906 (see Appendix G-1) shows concrete cutoff walls of unspecified depth at both upstream and downstream toes of Ambursen structure. |        |
|    | Grout Curtain - Unknown for both embankment and Ambursen sections.   |        |
| h. | <u>Spillway</u>  |        |
|    | Type - Overflow spillway. Consists of a reinforced concrete buttress (Ambursen) section with 10 bays, an upstream concrete face, and a downstream wood-planked face.                     |        |

**Length of Weir - 99 feet (includes 8.6-foot-wide by 6-foot-deep log sluice normally stop-logged closed up to spillway crest).**

**Upstream Channel - Reservoir immediately upstream of spillway section with approach between the spillway training walls.**

**Downstream Channel - About 25-foot-wide concrete paved apron from toe of spillway-plank-section to natural stream channel.**

**1. Outlet Pipes**

**Size - Four 24-inch-diameter.**

**Description - 4 cast iron pipes in separate bays of and discharging at bottom of bays of spillway section.**

**Control - Valves with handwheels. Two valves each on 3 of the pipes and one valve on the fourth pipe.**

## SECTION 2

## ENGINEERING DATA

2.1 DESIGN DATAa. Geology

There is no geologic information available in the data for this dam. The following information was obtained from current geologic maps and publications (see References 29 and 30), as well as from the site visit.

Black Creek Reservoir Dam is located at the approximate border between the generally hard rock types of the Adirondack Highlands and the weaker sedimentary rocks of the Mohawk Lowlands of the Appalachian Plateaus Province. Due to the presence of extensive Quaternary soil deposits in the vicinity of the dam, the underlying bedrock at the dam site is not known. However, on the basis of bedrock mapping in the area east of the dam, the bedrock at the dam site is inferred to be gneiss of uncertain age. With respect to regional geologic structure, the dam is inferred to be located approximately along the axis of an east-northeast plunging anticline which has been mapped east of the dam site. No surficial geology information is available for this area, according to a personal communication from the New York State Geological Survey.

b. Subsurface Investigations

A progress report on the construction of the dam, dated May 28, 1906 (see Appendix F3-19), makes reference to a foundation of "very fine, dense, clayey, sand completely interlarded with boulders of all sizes."

c. Dam and Appurtenances

The dam was designed in 1906 by the Ambursen Hydraulic Construction Company, 176 Federal Street, Boston, Massachusetts. The firm is no longer in business. The Owner has several prints of various design/construction drawings. These sheets are reproduced at reduced scale in Appendix G. Included in Appendix F3 are construction specifications for the dam (see Appendix F3-1) as well as a report on the proposed reservoir and dam by the original owner (see Appendix F3-13).

The specifications for the embankment sections of this dam call for a mixture of "selected clay and gravel" upstream of a concrete core wall, and for "gravel" downstream of the core wall. A progress report on the construction of the dam, dated May 28, 1906 (see Appendix F3-27), indicates that the core wall was built on "hardpan" at depths of 4 to 12 feet below the original ground surface.

## 2.2 CONSTRUCTION HISTORY

### a. Initial Construction

The dam was constructed in 1906 by the Ambursen Hydraulic Construction Company, the same firm that designed the dam. Several progress reports on the construction of the dam can be found starting on Appendix F3-19. No other records concerning the actual construction of the dam and appurtenances are known to exist.

A brief review of the construction history, as can be determined from the design/construction drawings and specifications, can be found on Appendix F2-2.

### b. Modifications, Repairs, and Maintenance

In the past, several of the outlet pipe valves have been replaced. The timber deck on the downstream side of the spillway has been replaced several times, the last time being 1974. Also in 1974 concrete repairs to the downstream ends of the spillway buttresses were made. There is also evidence of repair work to the spillway training walls.

An access hatch to the inside of the Ambursen section has also been installed in the downstream side of the spillway. This new hatch is now used in place of the old access shaft on the right side of the spillway.

### c. Pending Remedial Work

There are no known plans for any remedial work at the dam.

## 2.3 OPERATION RECORD

### a. Inspections

The only known inspections of the dam by the Owner are contained in an Engineer's Report by the Ambursen Engineering Company, dated 1963 (see Appendix F3-45), which generally concerned a proposed raising of the dam and spillway. This report, however, also contains several inspection reports for the dam.

The oldest inspection contained in the Engineer's Report is a November 16, 1948 inspection of the dam by E. N. Burroughs of the Ambursen Hydraulic Construction Company (see Appendices F3-62 to F3-68). The report noted that "imperfections as there are in the structure (concrete) seem to be the result of rock pockets and lack of spading as well as the effect of overwet concrete." The embankment was noted as being poorly constructed with "steep and irregular" downstream slopes. It was noted that counterforts on each abutment near the spillway crest had separated from the abutment. The report also noted that "there appeared to be no reinforcing rods that should have tied the counterfort(s) to the

22 abutment(s). The report also questioned whether any of the counterforts of the spillway abutments were constructed with reinforcing steel. Both spillway abutments were noted as being "in perpendicular alignment" and appeared not to have moved. Evidence of ice damage to the spillway abutments at their downstream ends was noted. The upstream concrete face of the spillway near the left abutment was noted to contain the "poorest spot of concrete". The report noted that there have been problems with some of the valves under the spillway due to freezing and that the floor slab was strengthened due to frost action. Finally the report stated that the downstream slope of the buttresses were "badly worn away", the original access shaft ladder steps were rusted nearly off in places, and the timber walkway inside the spillway was in "bad shape".

An inspection report dated July 16, 1943 by W. F. McCarter (see Appendixes F)-33 to F)-39) was also part of the Engineer's Report. This report noted that the "downstream abutment slope was never finished and very steep". The condition of the spillway abutment counterforts was also noted to be about the same as observed in 1940 with no evidence of repairs. The left spillway abutment was now noted, however, to be filled into the spillway section. The condition of the spillway concrete was noted to be in about the same or slightly worse shape than in 1940, again with no evidence of repairs. The walkway inside the dam was noted to be in excellent shape.

The dam was inspected on July 20, 1953 by the STS Construction Commission (see Appendixes F)-37 to F)-40). The dam was described as "in good condition". A photo of the dam taken during this inspection is included as Appendix F)-41.

The dam was also inspected by the STS-DIC on September 14, 1971 (see Appendix F)-74). This report indicated that the concrete of the dam was showing signs of wear, had exposed reinforcing steel in places, and required major repair. The report also noted that there was evidence of periodic maintenance being performed. Photos taken during the inspection are included on Appendix F)-77.

#### **b. Performance Observations, Water Levels, and Discharges**

Records of spillway outflow (depth of flow over the spillway) exist from January 1914 to the present (see summary on Appendix F)-83). The highest recorded level of outflow was 2.2 feet over the spillway crest and occurred May 3, 1914. Depth of flow over the spillway continues to be recorded on daily reports which are sent monthly to the Water Board.

#### **c. Past Floods and Previous Failures**

There have been no known floods at or previous failures of the dam.

## 2.4 EVALUATION

### a. Availability

As listed on Appendix F1, engineering data and records for the dam were available from the Owner and the Dam Safety Section of the NYSDOT. This data was reviewed, and copies of all of the relevant records found are included in chronological order in Appendices F1 and F2. Appendix F2, Checklist for General Engineering Data and Information with Dam Owner, also contains pertinent engineering information. A current pamphlet titled "Our Most Valuable Natural Resource-Water" was also available from the Owner and contained useful information about the dam, but was not appended to this report.

### b. Adequacy

Available data consisted of drawings, construction specifications, construction reports, inspection reports, photos, letters, an engineer's report, capacity data, and maximum discharge data. Much data on complete design drawings, design calculations, record drawings and complete data on foundation and abutmentment walls were not available. The lack of such in-depth engineering data does not permit a comprehensive review. Therefore, the available data was not adequate by itself to permit an assessment of the dam.

### c. Validity

Based on field observation and checking, some of the data is not valid. Drawings of the spillway section differ in certain aspects from what actually exists in the field.

The log sluice is only about half as wide (8.6 feet) as the drawings indicate (about 18 feet shown on Appendix C-2).

The outlet pipes are located in bays 2 to 6, rather than in bays 5 to 9 as noted on Appendix C-2.

The ends of the buttresses between bay 7 and bay 10 do not exist as shown on Appendix C-2. The ends of the buttresses in that area consists of a single solid concrete step between bays 7 and 10.

The elevation base of the drawings in Appendix C appears to be about 1,220 feet lower than MVD.

## SECTION 3

## VISUAL INSPECTION

## 3.1 FINDINGS

a. General

Black Creek Rectangular Dam was inspected on June 3, 1961. The inspection party (see Appendix B-1) was accompanied by Mr. Russell Lofgren, Principal Engineer of the Utah Board of Water Supply (the Owner). The weather was overcast and warm, with showers occurring around noon. The water surface was at about the spillway crest, EL 1110. The Visual Inspection Checklist is included as Appendix B, while selected photos taken during the inspection are included in Appendix A and as the Overview Photo at the beginning of this report. Appendix A-1 is a photo index map.

b. Dam

There is no evidence of sloughs or slides of the embankment.

Crest - There is essentially no vegetation, except for some sparse grass and low weeds, on the crest of the embankment between the Anderson spillway structure and the left abutment (see Photo A-2A). Small trees and some brush are growing on the crest of the embankment section between the Anderson structure and the right abutment (see Photo A-2B). The top of a concrete core wall is visible near the downstream edge of the crest of both embankment sections and extends the entire length of the embankments.

Upstream Slope - The upstream slope of both embankment sections is covered with trees and some brush, and is protected with riprap about 12 to 18 inches in size (see Photo A-3A).

Downstream Slope - The downstream slope of both embankment sections is covered with a dense growth of trees and brush, which makes it impossible to inspect the slopes adequately (see Photos A-3B and A-4A).

Abutments - Both abutments appear to be soil; no bedrock outcrops were observed in the vicinity of the dam. There is a soft, wet area with rust stained standing water at the lower part of the contact between the downstream slope and the right abutment. A dirt road, parallel to the valley, crosses the left abutment next to the end of the embankment.

## c. Appurtenant Structures

### 1) Spillway and Discharge Channel

The spillway is an Amburson (concrete buttress) overflow section with concrete training walls, a concrete upstream face, and a timber plank downstream face (see Overview Photo and Photos A-3A and A-3B). Inside the Amburson section there are 9 buttresses (10 bays) with a wooden walkway through them that provides access to the outlet pipe valves.

On the upstream face of the Amburson spillway section the concrete is spalled and some aggregate is exposed. There is a diagonal crack in the upstream face from the right side of the spillway crest down along the face (see Photo A-8A).

The left training wall of the spillway is in poor condition and bends and tilts into the spillway channel at its upstream end (see Photo A-4A). The counterforts upstream of the core wall and the core wall itself are all separated from the left training wall by several inches. The first counterfort downstream of the core wall is separated from the left training wall by about 6 inches (see Photo A-6B). Other counterforts at the left training wall, downstream of the core wall, have spalled concrete, disintegrated concrete, and exposed reinforcing steel. It is possible that the core wall/counterfort wall and counterfort/training wall intersections are not reinforced with steel. There is a crack in the left training wall, about 1/2 inch wide, from the top of the wall down to the spillway crest (see Photo A-5A). There is a large spalled area with exposed reinforcement at the spillway crest/left training wall interface. At the downstream end of the wall, along the bottom, the wall is also spalled and its reinforcement is exposed (see Photos A-7A and A-7B). There is a large diagonal crack at the downstream end of the wall, offset about one inch horizontally, that has been repaired with new concrete added to the end of the training wall. Over the entire left training wall the concrete is stained, eroded, and contains hairline cracks (see Photos A-5A and A-7A). The most downstream counterfort of the left training wall leans downstream and some concrete along the top of the wall has spalled off.

The right training wall of the spillway is also in poor condition. The second counterfort upstream of the core wall is broken off diagonally and is presently held in place by its reinforcing steel. There is a crack at the core wall/right training wall interface and all of the counterforts downstream of the core wall are separated at the top from the right training wall by 2 to 5 inches. The last counterfort downstream is broken away from the right training wall and it leans downstream by over 2 feet. The right training wall is spalled and eroded at the bottom along its

downstream end. There are repaired areas with new concrete near the bottom of the wall (see Photos A-3B and A-8B). There is some staining, hairline cracking, and encrustation on parts of the entire wall.

The downstream face of the spillway section is constructed of timber planking. (See Overview Photo and Photo A-7A). The planking is weathered but the planks and their timber supports appear to be sound.

The downstream ends of the buttresses of the Ambursen section have been repaired with concrete and are in good condition. A concrete step which replaces the buttress ends of the 3 bays furthest to the right (see Overview Photo and Photo A-3B) is eroded and deteriorated along its downstream edge.

The inside of the Ambursen section (underneath the spillway) where the outlet pipe valves are located could not be thoroughly inspected due to poor lighting, lack of access to some bays, and flowing water from the outlet pipes. In general, the observable concrete surfaces inside the Ambursen section appeared to be in good condition. There was some wear of the concrete surfaces due to weathering. The floor of the section was very rough. Stalagmites of calcium carbonate and efflorescence were present at the intersections of concrete surfaces and at the construction joints (see Photos A-9A and A-9B). No leakage into the inside of the Ambursen section was observable.

The concrete-paved apron of the discharge channel at the toe of the spillway section (see Photo A-10B) was worn and uneven due to water action. About a 30-foot-wide area on the right side consists of exposed grouted large stone and is about 3 inches lower than the remaining concrete. This area is eroded and spalled and there are several holes into the paving (see Photo A-8B).

The dam has a log sluice near the right spillway training wall which is normally kept stop-logged shut (see Overview Photo). The log sluice was in good condition.

The walkway through the Ambursen section consists of bare wood planking elevated about 8 feet above the floor between bays 3 and 10 (see Photo A-9A for typical view). Access has been blocked off to bays 1 and 2. The wooden walkway was springy but sound.

## 2) Outlet Pipes

The dam has four valved 24-inch cast iron outlet pipes located inside bays of the Ambursen spillway section (see Photo A-7B). The flow of water from the outlet pipes obscures them and makes them unobservable for inspection. The intake ends of the outlet pipes are upstream of the spillway section in the reservoir and are also unobservable. The valves on the pipes (1 valve on pipe in bay 3, 2 valves on each of the remaining 3 pipes)

2 are rusted, poorly lubricated, and difficult to operate (see Photo A-10A for valves in bay 6). Operation of the valves requires 2 men using added leverage on the valve handwheels.

d. Reservoir Area

The slopes around the reservoir are low, flat, and tree-covered. No evidence was observed to indicate problems of slope stability on the perimeter of the reservoir or of significant sedimentation in the reservoir.

e. Downstream Channel

Erosion, apparently due to groundwater discharge, has occurred on the left bank of the downstream channel close to the toe of the embankment near the training wall at the left end of the Ambursen structure. A scarp about 3 feet high has developed in the bank due to this erosion (see Photo A-14).

The channel downstream of the dam is about as wide as the spillway section near the dam and narrows further downstream. There is heavy tree growth along the channel banks and a bridge crossing downstream about 300 feet (see Photo A-10H).

3.2 EVALUATION

The poor condition of the spillway training walls/counterfort joints could pose a stability problem for the training walls. The poor condition of the spillway training wall concrete and the tilting of the left training wall are also a cause for concern.

Trees growing on the crest of the right embankment section and on the upstream and downstream slopes of both embankment sections could lead to seepage and piping (internal erosion) problems. Tree blows over and pull out its roots or if a tree dies and its roots rot.

A soft, wet area with standing water on the contact between the downstream slope and the right abutment may be indicative of a seepage problem which, if not corrected, could become worse and adversely affect the stability of the embankment.

The lack of erosion protection on the crest of the embankment between the Ambursen structure and the left abutment, and also on the dirt road which crosses the left abutment, makes the embankment and left abutment susceptible to erosion if the dam should be overtopped.

320 Erosion on the left bank of the downstream channel close to the toe of the dam, apparently due to groundwater discharge, could become a focus for seepage through the foundation and/or embankment and, if not controlled, could lead to seepage and piping problems.

The inside of the Ambursen section should be more thoroughly inspected when the outlet pipes are closed.

The outlet pipe valves should be maintained so that they operate more easily.

The deterioration of the concrete apron downstream of the spillway is also a cause for concern.

## SECTION 4

## OPERATION AND MAINTENANCE PROCEDURES

4.1 OPERATION PROCEDURES

There are no written operation procedures for the dam.

Black Creek Reservoir is presently used for flood control of spring runoff and to supply compensation water to Hinckley Reservoir. The water level is normally at or below the spillway crest and all four outlet pipes are normally partially open (all valves opened about five turns). The log sluice is always kept stop-logged up to the spillway crest.

Just before spring runoff all four outlets are completely opened and the reservoir is drained to provide flood storage capacity. The outlets are closed partially down again when the reservoir fills to the spillway crest and remain that way until the next spring.

At the time of the June 3 inspection the reservoir level was at about the spillway crest and all four outlets were partially open.

4.2 MAINTENANCE OF DAM AND OPERATING FACILITIES

There are no maintenance procedures for the dam.

A caretaker for the dam resides in a house at the dam site owned by the City of Utica Board of Water Supply. The caretaker visits the dam daily and records the water level. The caretaker does not operate the outlet valves at the dam. Water Department personnel from the City of Utica operate the valves each spring.

Brush and trees were cut on the left portion of the embankment in the past. No other maintenance of the dam, other than concrete repairs to and replacement of the wooden deck of the spillway, have occurred in the recent past.

4.3 EMERGENCY ACTION PLAN AND WARNING SYSTEM

There is no emergency action plan and warning system for the dam.

4.4 EVALUATION

Maintenance of the dam and appurtenances is unsatisfactory. There have been some repairs to the dam appurtenances but the embankment is overgrown with trees and brush. More effective operation and maintenance procedures, as well as major repairs, need to be developed and implemented in order to avoid the continued deterioration of the dam.

The Owner should develop an emergency action plan outlining action to be taken to minimize the downstream effects of an emergency, together with an effective warning system.

## SECTION 5

## HYDROLOGY AND HYDRAULICS

5.1 DRAINAGE AREA CHARACTERISTICS

Black Creek Reservoir and Black Creek Reservoir Dam are located on Black Creek in central New York. About 9 miles downstream of the dam Black Creek discharges into the Hinckley Reservoir which is located on West Canada Creek. West Canada Creek drains to the southwest and discharges to the Mohawk River.

The total drainage area at the dam is about 23.99 square miles, of which about 0.50 square miles (322.7 acres), or only about two percent, is actual reservoir surface at the spillway crest. Being in the foothills of the Adirondack Mountains, the topography is characterized by slopes of from 5% to 10%. Elevations in the drainage area vary from EL 1310 to EL 2370 (see Appendices C-5 and C-6).

5.2 ANALYSIS CRITERIA

The U.S. Army Corps of Engineers Hydrologic Engineering Center's Program HEC-1 DB (Reference 3) was used to develop the test flood hydrology and perform the reservoir routing.

The purpose of this analysis was to evaluate the dam and spillway with respect to their surcharge storage and spillway capacity. Accordingly, it was assumed that the water surface was at the spillway crest at the start of the flood routing. In addition, it was assumed that one of the four outlet pipes was fully open for analysis purposes. Normally all four pipes are always partially open, and their capacity for that condition has been estimated to be that of one pipe fully open.

A constant base flow of 2 cfs per square mile was chosen to represent average conditions in the drainage area and was inputted into the program for all subareas.

The index PMP (probable maximum precipitation) inputted to the HEC-1 DB program was 19 inches for a 24-hour duration all-season storm over a 200-square-mile basin, according to HMR 33 (Reference 4). Maximum 6-hour, 12-hour, 24-hour, and 48-hour precipitation for the actual size of the drainage area (same for 10 square miles or less) were inputted to the program as percentages of the index PMP in accordance with HMR 33. A storm reduction coefficient was then applied internally by the program in order to transpose or center the storm over the actual total drainage area. Thus, the corrected 48-hour PMP for the actual total drainage area became 20.8 inches. All rainfall was distributed using the Standard Project Storm arrangement embedded in the program.

Appendix C-7 summarizes the subarea, loss rate, and unit hydrograph data inputted to the program. Only two subareas were used. Subarea 1 consists of all the drainage area tributary to the reservoir, and Subarea 2 consists of just the reservoir surface. For the land in Subarea 1, loss rates were assumed to be 1.0 inch initially and a constant 0.1 inch per hour thereafter. A Snyder basin coefficient was assumed for average conditions and a Snyder peaking coefficient was chosen from the 1976 Upper Hudson and Mohawk River Basins Hydrologic Flood Routing Models (Reference 20). A conservative standard lag time was computed. The program uses the inputted lag time and Snyder peaking coefficient to solve by iteration for approximate Clark coefficients which are then used to calculate the runoff hydrograph.

For the reservoir surface making up Subarea 2, loss rates were set to zero so that rainfall would equal rainfall excess, or runoff. Assuming no delay in the rainfall/runoff response, a constant unit hydrograph for a rainfall duration equal to the HEC-1 DB calculation interval was developed per Appendix C-7 and inputted to the program.

The floods selected for analysis were the PMF (probable maximum flood) and 1/2 PMF. Floods as ratios of the PMF (e.g., 1/2 PMF) were taken as ratios of runoff, not of precipitation. Peak inflow for the PMF is about 24,000 cfs or 1,000 csm (cfs per square mile). Peak outflow is reduced by reservoir routing to about 21,800 cfs (909 csm). For 1/2 PMF the peak inflow is about 12,000 cfs (500 csm) and the routed peak outflow is about 10,000 cfs (417 csm).

### 5.3 RESERVOIR CAPACITY

Storage capacity data for the reservoir was obtained from storage capacity data prepared for the City of Utica Board of Water Supply by Adrian L. Lashure, Land Surveyor (see Appendices F3-78 to F3-80). A hand tabulation of the reservoir volumes inputted to the program is on Appendix C-8.

At the spillway crest, EL 1310, the reservoir has a capacity of 3,584 acre-feet. At the top of dam the reservoir has a capacity of 5,848 acre-feet. Surcharge storage between the spillway crest and top of dam amounts to 2,264 acre-feet, or about 1.8 inches of runoff from the total 23.99-square-mile drainage area. Therefore, the reservoir has some capacity to attenuate peak inflow.

### 5.4 SPILLWAY CAPACITY

The dam has a 99-foot-long overflow spillway in the form of an Ambursen section. The top of the dam is about 6 feet higher than the spillway crest.

The discharge capacity for the spillway was computed assuming critical flow over an ideal broad-crested weir. Reduction in discharge capacity due to abutment contractions was neglected. The

appropriate weir parameters were inputted to the HEC-1 DB program which did the discharge computations during the flood routing. A tabulation of hand-computed discharges is presented on Appendix C-9. With the water level at EL 1316 (i.e., water level at top of dam) the spillway discharges about 4,490 cfs.

As stated earlier, the dam has four valved outlet pipes which are normally partially open (each valve opened 5 turns). The outlet pipe capacity for the normal condition is estimated to be the capacity of one of the 24-inch outlet pipes fully open. The capacity of one outlet pipe was computed by the program using an orifice equation for free discharge. The discharge computations for a single pipe are presented on Appendix C-9. The capacity of the outlet pipes for the normal condition is estimated to be about 90 cfs when the water level is at the top of dam.

Total discharge computations are also summarized on Appendix C-9. Total discharge from the dam is the sum of the discharges from the spillway and the equivalent of one outlet pipe fully open, plus flow over the dam for the overtopping condition. The top of the dam was modeled as a broad-crested weir with less than ideal characteristics. With the water level at the top of dam, EL 1316, total discharge capacity is due to the spillway plus the equivalent of one outlet pipe fully open, or about  $4,490 + 90 = 4,580$  cfs, or say 4,600 cfs.

### 5.5 FLOODS OF RECORD

As noted in Section 2.3b, the highest recorded discharge at the dam site was about 2.2 feet over the spillway crest on May 3, 1914. Using the spillway capacity data developed in Section 5.4, the corresponding flood discharge is estimated to have been about 1,800 cfs (42 csm), or only about 5% of the PMF peak outflow predicted.

### 5.6 OVERTOPPING POTENTIAL

The results of the overtopping analysis using the HEC-1 DB program are summarized in Table 5.1. The overtopping analysis computer input and output for the PMF and 1/2 PMF are included starting on Appendix C-10.

As noted from Table 5.1, the PMF overtops the dam by 5.3 feet maximum and 1/2 PMF overtops the dam by 2.2 feet maximum, with durations of overtopping of 6.3 hours and 4.2 hours, respectively. Peak inflows are 24,000 cfs for the PMF and 12,000 cfs for the 1/2 PMF. Peak outflows are reduced by reservoir routing to 21,800 cfs for the PMF and 10,000 cfs for the 1/2 PMF. Time to maximum stage or the time from the start of the 48-hour storm to peak outflow, is between 46 and 48 hours for both flood events. The peak portion of the inflow and outflow hydrographs for the PMF and 1/2 PMF are shown by the computer plots on Appendices on C-16 and C-17. Total

**TABLE 5.1**  
**BLACK CREEK RESERVOIR DAM**  
**OVERTOPPING ANALYSIS**

**CONDITIONS**

Total Drainage Area = 23.99 square miles  
Start Routing at Spillway Crest EL 1310  
Top of Dam EL 1316  
Total Project Discharge Capacity at Top of Dam = 4,600 cfs ±  
due to spillway and one outlet pipe fully open.  
Some values rounded from computed results

	PMF	1/2 PMF (a)
<b><u>INFLOW</u></b>		
48-hour Rainfall ( inches )	20.8	12.2 (b)
48-hour Rainfall Excess ( inches ) (c)	17.2	8.6 (d)
Peak Inflow (cfs)	24,000	12,000
(csm)	1,000	500
<b><u>OUTFLOW</u></b>		
Peak Outflow (cfs)	21,800	10,000
(csm)	909	417
Time to Peak Outflow (hours)	46.8	47.5
Maximum Storage (acre-feet)	8,506	6,861
Max. W.S. Elevation (feet-NGVD)	1,321.3	1,318.2
Minimum Freeboard (feet)	overtopped	overtopped
Maximum Depth over Dam (feet)	5.3	2.2
Duration of Overtopping	6.3	4.2

- (a) One-half of PMF total runoff, including base flow. For PMF base flow = 2 cfs per square mile = 48 cfs ±.
- (b) Approximation assuming total losses are the same as for the PMF.
- (c) Rainfall Excess = Rainfall for the Reservoir Surface. For the rest of the drainage area, losses are assumed to be 1.0 inch initially and 0.1 inch per hour thereafter.
- (d) Equal to one-half of PMF value.

project discharge capacity at the top of dam is due to the spillway and the equivalent of one outlet pipe fully open and is about 4,600 cfs, or about 21% of the PMF peak outflow and about 46% of the 1/2 PMF peak outflow.

### 5.7 EVALUATION

Maximum spillway discharge capacity (with one outlet pipe fully open) is only about 21% of the PMF peak outflow. The 1/2 PMF would overtop the earth embankment and would probably cause failure. It is judged that failure due to overtopping would significantly increase the hazard to loss of life downstream from that which would exist just prior to failure. Therefore, in accordance with Corps of Engineers' screening criteria for review of spillway adequacy, spillway capacity is considered "seriously inadequate" and the dam is assessed as "unsafe, non-emergency".

## SECTION 6

### STRUCTURAL STABILITY

#### 6.1 EVALUATION OF STRUCTURAL STABILITY

##### a. Visual Observations

The following visual observations, which are discussed in detail in Section 3, are indicative of potential long-term stability problems at Black Creek Reservoir Dam:

- 1) There is separation of the spillway training walls at their joints with the counterforts and the embankment core wall. The left training wall also bends and tilts toward the spillway section.
- 2) Trees growing on the crest of the right embankment section and on the upstream and downstream slopes of both the left and right embankment sections.
- 3) A soft, wet area with standing water on the lower part of the contact between the downstream slope of the embankment and the right abutment.
- 4) Lack of erosion protection on the crest of the left embankment section and on the dirt road which crosses the left abutment.
- 5) Erosion, apparently due to groundwater discharge, of the left bank of the downstream channel close to the toe of the dam.

##### b. Design and Construction Data

No information is available about the soils in the embankment sections of the dam. Available drawings do show the concrete core wall in the embankment sections, but do not indicate how deep the core wall extends into the foundation. Conflicting statements appear in various records as to the nature of the foundation soils under the embankment sections and Ambursen spillway section. In one document the foundation soil is referred to as gravel and in another it is referred to as sand and clay.

A drawing representing a stability analysis for a proposed raising of the Ambursen spillway section was found (see Appendix F3-69). The proposed raising was never carried out and the results on the stability drawing are sketchy.

c. Operating Records

No operating records were found or operational problems reported which would adversely affect the stability of the dam.

d. Post-Construction Changes

No post-construction changes are known which would adversely affect the stability of the dam.

e. Seismic Stability

This dam is in Seismic Zone 2. According to the Recommended Guidelines (Reference 1), a seismic stability analysis is only required for the portion of the dam which is a gravity structure.

## 6.2 STABILITY ANALYSIS

The Amberson spillway structure is a hollow gravity section, consisting of bays and buttresses, about 99 feet long with a uniform height of about 30 feet from spillway crest to bottom of foundation. An independent structural stability analysis was performed on a typical section taken through one of the buttresses. The section includes the entire width of the buttress with all the loads of one bay (half a bay on each side) acting on the buttress. The cross section geometry is based on the limited design/construction drawings available (see Appendix G) and observation during the visual inspection. The following loading cases were analyzed:

- Case 1 - Normal pool at spillway crest, no tailwater by observation, full headwater uplift, earth load on upstream side 2.5 feet higher than bottom of foundation, and apron resistance on downstream side.
- Case 2 - Normal pool at spillway crest, ice load of 3 kips per linear foot for ice 1.0 foot thick, remaining conditions same as Case 1.
- Case 3 - Half PMF pool at EL 1318.2 or 8.2 feet above spillway crest, flood tailwater estimated at 6 feet deep or 22 feet below spillway crest, full headwater and tailwater uplift, remaining conditions same as Case 1.
- Case 4 - Full PMF pool at EL 1321.3 or 11.3 feet above spillway crest, flood tailwater estimated at 9 feet deep or 19 feet below spillway crest, remaining conditions same as Case 3.
- Case 5 - Normal pool at spillway crest, seismic loads applicable to Seismic Zone 2 (accelerations of 0.05g horizontally upstream and 0.025g vertically down), remaining conditions same as Case 1.

The results of the stability analysis are summarized in Table 6.1. The computations are included as Appendix D.

For all loading cases analyzed except Seismic (Case 5), minimum satisfactory overturning stability is considered to be a factor of safety of 1.5 with the resultant passing through the middle third of the base. For sliding stability, because of the high loading conditions and the conservative assumptions made about foundation material properties, a minimum satisfactory factor of safety of 2.0 is considered appropriate for all the loading cases analyzed, except seismic, rather than the customary 1.0.

For seismic loading (Case 5), minimum satisfactory overturning stability is considered to be a factor of safety of 1.0 with the resultant passing anywhere through the base. For seismic sliding stability, a minimum factor of safety of 1.5 is considered appropriate.

For all loading cases, both overturning and sliding stability must be satisfactory in order for stability of the section to be satisfactory.

As noted from Table 6.1, the Ambursen spillway section is unstable for all loading conditions, including the normal spring-summer-fall condition (Case 1) and the winter ice load condition (Case 2). Sliding is a critical problem.

Additional analysis indicates that if the upstream and downstream cutoff walls are assumed to exist and to be effective in resisting sliding, the sliding factor of safety for Case 1, normal pool, would increase from 0.11 to over 4.0, which would be satisfactory (see calculations on Appendix D-16). Similar improvement in sliding stability would apply to all the other cases as a result of the cutoff walls. However, unless the cutoff walls are reinforced, overturning stability would remain unchanged as unsatisfactory or unstable as shown depending on the loading case.

For Cases 3 and 4, the 1/2 PMF and PMF conditions, it should be noted that the full weight of the flowing water on the downstream face of the section was taken into account as a resisting force. Considering the high head and discharge for the 1/2 PMF and PMF conditions, it is probable that the flowing water would exert little to no pressure - or even negative pressure - on the face of the section. Therefore, actual stability of the spillway under such flood conditions might be even more unsatisfactory than presently indicated.

Also for Cases 3 and 4, the inside of the Ambursen section was assumed to be flooded to the same level as the flood tailwater. The weight of the water inside the section acts as an additional

TABLE 6.1  
BLACK CREEK RESERVOIR DAM  
STABILITY ANALYSIS OF AMBURSEN SPILLWAY SECTION

CASE	----- OVERTURNING -----			SLIDING FACTOR OF SAFETY (c)
	FACTOR OF SAFETY (a)		LOCATION OF RESULTANT (b)	
1- Normal Pool	1.02	unsatisfactory	0.15b	0.11 unstable
2- Normal Pool plus Ice Load	0.98	unstable	-0.19b	0.10 unstable
3- Half PMF Pool	1.13	unsatisfactory	0.34b	0.36 unstable
4- Full PMF Pool	1.17	unsatisfactory	0.38b	0.43 unstable
5- Normal Pool plus Seismic Load	0.98	unstable	-0.27b	0.06 unstable

- (a) Overturning factor of safety is ratio of resisting moments to driving moments taken about the toe.
- (b) Distance from toe to point where resultant passes through base, expressed in terms of base dimension "b". Middle third of base is 0.33b to 0.67b.
- (c) Sliding factor of safety is ratio of resisting forces to driving forces taken along horizontal failure plane.

resisting force. Due to the high spillway flows during the 1/2 PMF and PMF, flooding of the inside of the Ambursen section may not occur quite as high as the tailwater level outside the section. Therefore, for this second reason, actual stability of the spillway section under such flood conditions may be even more unsatisfactory than presently indicated.

In view of the apparent instability of the Ambursen spillway, it is recommended that a detailed structural stability investigation of the spillway be conducted to better assess its stability under all loading conditions. This should include appropriate field and laboratory work to determine actual foundation material properties and structural details, including accurate cross sections of the spillway. The investigation should determine what modifications to the spillway, if any, are necessary to achieve satisfactory stability.

## ASSESSMENT AND RECOMMENDATIONS

## SECTION 7

7.1 ASSESSMENTa. Safety

Visual inspection of Black Creek Reservoir Dam revealed the following deficiencies which affect the safety of the dam:

- 1) Separation of the spillway training walls at their joints with the counterforts and the core wall. The left training wall also bends and tilts toward the spillway section.
- 2) General deterioration of the spillway concrete, with cracking and exposed reinforcement.
- 3) Trees growing on the crest of the right embankment section and on the upstream and downstream slopes of both the left and right embankment sections.
- 4) Erosion of the left bank of the downstream channel close to the toe of the dam.
- 5) A soft, wet area with standing water on the lower part of the contact between the downstream slope of the embankment and the right abutment.
- 6) Lack of erosion protection on the crest of the embankment section between the Ambursen section and the left abutment and on the dirt road which crosses the left abutment.
- 7) Outlet pipe gates which are difficult to operate.
- 8) Deterioration of the concrete apron at the downstream toe of the spillway.

Hydrologic and hydraulic analysis indicates that maximum spillway discharge capacity is only about 21% of the PMF peak outflow. The 1/2 PMF would overtop the earth embankment and would probably cause failure. It is judged that failure due to overtopping would significantly increase the hazard to life downstream from that which would exist just prior to failure. Therefore, in accordance with Corps of Engineers' screening criteria for review of spillway adequacy, spillway capacity is considered "seriously inadequate" and the dam is assessed as "unsafe, non-emergency".

Structural stability analysis of the Ambursen spillway section indicates that it is unstable for all loading conditions,

including the normal spring-summer-fall condition and the winter ice load condition.

**b. Adequacy of Information**

Available information, together with that gathered during the visual inspection, while considered adequate for this Phase I inspection, is deficient in the following respects:

- 1) A dense cover of trees and brush on the downstream slopes of both the right and left embankment sections makes it impossible to inspect these sections adequately.
- 2) The flow of water from the outlet pipes makes it difficult to inspect the inside of the Ambursen spillway section adequately.
- 3) There is no data available on the actual material properties of the soil foundation under the Ambursen spillway section or on structural details of the foundation. The lack of such data critically affects the structural stability analysis of the spillway.
- 4) Inconsistencies in the engineering data available, based on field observation and checking, are itemized in Section 2.4c.

**c. Need for Additional Investigations**

The following detailed engineering investigations should be performed by a registered professional engineer qualified by training and experience in the design of dams:

- 1) Perform a detailed hydrologic and hydraulic analysis to better assess spillway adequacy. This should include an investigation of the site specific characteristics of the watershed.
- 2) Perform a detailed structural stability analysis of the Ambursen spillway section to better assess its stability under all load conditions. This should include appropriate field and laboratory work to determine actual foundation material properties and structural details, including accurate cross sections of the Ambursen spillway section.
- 3) Investigate the separation of the spillway training walls at their joints with the counterforts and the core wall, as well as the tilting of the left training wall.
- 4) Investigate the erosion on the left bank of the downstream channel near the toe of the dam.

- 5) Investigate the soft, wet area on the contact between the downstream slope of the embankment and the right abutment.
- 6) Investigate the inside of the Ambursen spillway section when the outlet pipes are closed.

d. Urgency

As recommended below in Section 7.2a, a program to visually inspect the dam at least once a month should be instituted immediately. As recommended below in Section 7.2b, development of a surveillance program and an emergency action plan should be completed within 3 months after receipt of this Phase I Inspection Report by the Owner. While the action plan is being developed, and within 3 months after receipt of this report by the Owner, the investigations recommended above in Section 7.1c should be started.

Any remedial work deemed necessary as a result of these investigations should be completed within 18 months after receipt of this report by the Owner.

Measures recommended below in Section 7.2c should be completed within 12 months after receipt of this report by the Owner.

7.2 RECOMMENDED MEASURES

The following work should be performed by the Owner. Where engineering assistance is indicated, the Owner should engage a registered engineer qualified by training and experience in the design of dams. Assistance by such an engineer may also be useful for some of the other work.

a. Complete Immediately

Institute a program to visually inspect - not just casually look at - the dam and its appurtenances at least once a month.

b. Complete Within 3 Months

Develop a surveillance program for use during and immediately after heavy rainfall or snowmelt, and also an emergency action plan outlining action to be taken to minimize the downstream effects of an emergency, together with an effective warning system.

c. Complete Within 12 Months

- 1) Contingent on the results of the detailed hydrologic and hydraulic analysis, the detailed structural stability analysis, and other investigations recommended in 7.1c, repair the deteriorated concrete of the Ambursen spillway section.

- 2) Remove trees and brush and their root systems from the embankment and from a zone 50 feet wide next to the downstream toe in accordance with specifications and field observation of the work by an engineer. Backfilling the zones where stumps and roots have been removed should be done with proper material and procedures. Continue to keep these same areas clear by cutting, mowing, and cleanup at least annually.
- 3) Provide erosion protection for the embankment in accordance with design and field observation of the work by an engineer.
- 4) Adjust the outlet pipe valves so that they operate more easily and perform regular maintenance.
- 5) Repair the deteriorated concrete apron downstream of the spillway.
- 6) Develop and implement effective routine operation and maintenance procedures for the dam and its appurtenances.
- 7) Institute a program of comprehensive technical inspection of the dam and its appurtenances by an engineer on a periodic basis of at least once every two years.

d. Complete Within 18 Months

The following remedial work should be completed by the Owner. A qualified, registered professional engineer should design and observe the construction of the remedial work.

- 1) Appropriate modifications as a result of the detailed hydrologic and hydraulic analysis.
- 2) Appropriate modifications as a result of the detailed structural stability investigation of the Ambursen spillway section.
- 3) Appropriate modifications as a result of investigating the separation of the spillway training walls at their joints with the counterforts and the core wall, as well as the tilting of the left training wall.
- 4) Appropriate modifications as a result of investigating the erosion on the left bank of the downstream channel near the toe of the dam.

- 5) Appropriate modifications as a result of investigating the soft, wet area on the contact between the downstream slope of the embankment and the right abutment.
- 6) Appropriate modifications as a result of investigating the inside of the Ambursen spillway section when the outlet pipes are closed.

I

APPENDIX A  
PHOTOGRAPHS

LEFT

0.00

3A

DAM

SCARP

10B

6A

6B

2A

5B

0.83

1.00

4A

3B

4B

7A

7B

1

2

3

4

5

6

7

8

9

10

ACCESS MATCH

8B

SPILEWAY CREST

9A

9B

10A

OUTLET PIPES

OVERVIEW PHOTO

LOG SLUIE

2B

8A

5A

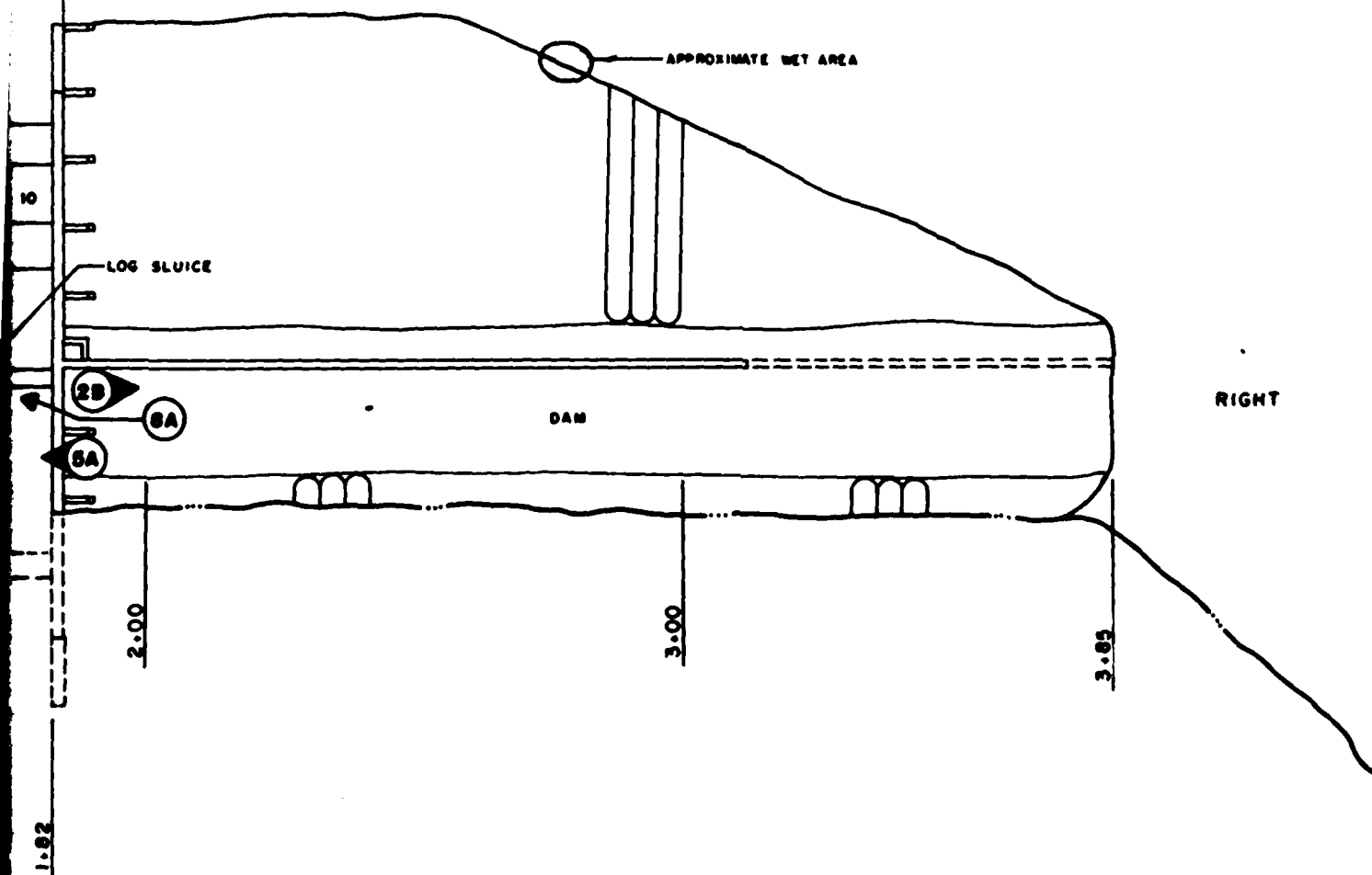
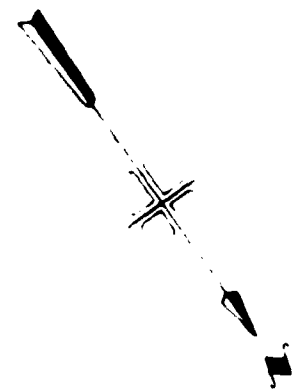
2.00

1.82

BLACK CREEK RESERVOIR

PROJ

OVERVIEW  
PHOTO



# BLACK CREEK RESERVOIR DAM PHOTO INDEX MAP

TOWN OF NORWAY

HERKIMER CO., N.Y.

SCALE NONE

DATE JULY 1981



C T MALE ASSOCIATES P C

1000 TROY ROAD SENECA FALLS N.Y. 13150

PROFESSIONAL ENGINEER LAND SURVEYOR LAND PLANNING CONSULTANT

PROJECT NO. 58-01-00005/80.845

A-1

DWG. NO. 81-4

1 2



A-2A Top of dam and left abutment viewed from left end of spillway.  
Dirt road in background is over abutment and is perpendicular  
to axis of dam - 6/3/81



A-2B Top of dam viewed from right end of spillway toward right  
abutment - 6/3/81



A-3A Upstream slope of embankment between spillway and left abutment. Note boulder riprap and brush on slope - 6/3/81



A-3B Training wall at right downstream end of spillway - 6/3/81



A-4A Downstream slope of embankment to right of spillway - 6/3/81



A-4B Severe bank erosion with scarp about 3 feet high in what appears to be the left bank of the valley at the toe of the embankment close to the training wall at left end of the spillway - 6/3/81



A-5A Crest and left training wall of spillway. Note crack from top of wall to spillway crest - 6/3/81



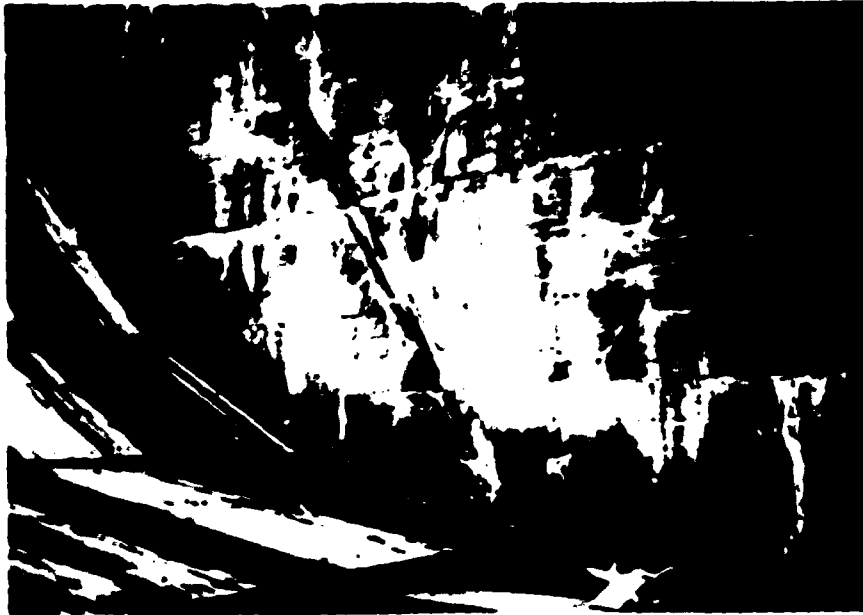
A-5B Crest and right training wall of spillway - 6/3/81



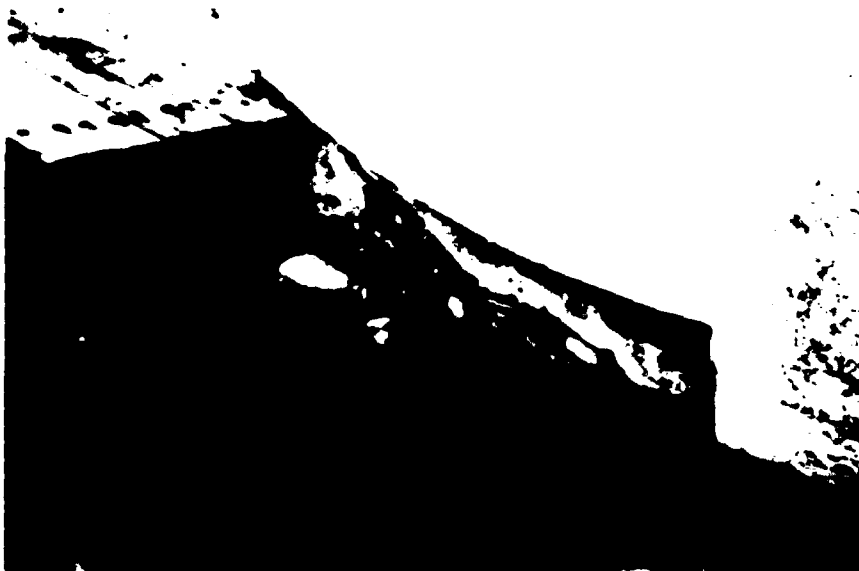
A-6A Top of left training wall. Note  
bend and tilt in wall toward spillway  
6/3/81



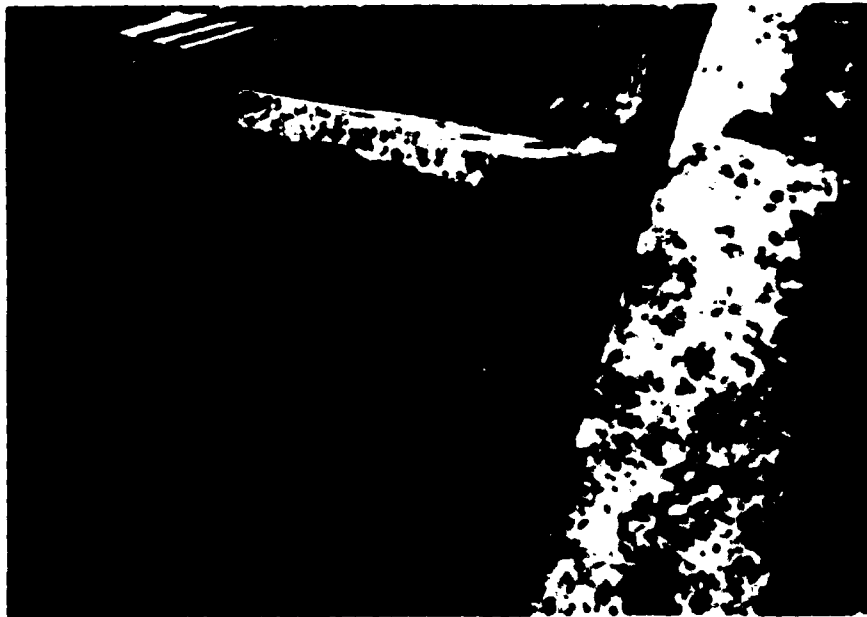
A-6B Gap between counterfort and left training wall - 6/3/81



A-7A Downstream face of spillway and left training wall contact.  
Note poor condition of concrete - 6/3/81



A-7B Exposed reinforcing steel at base of left training wall - 6/3/81



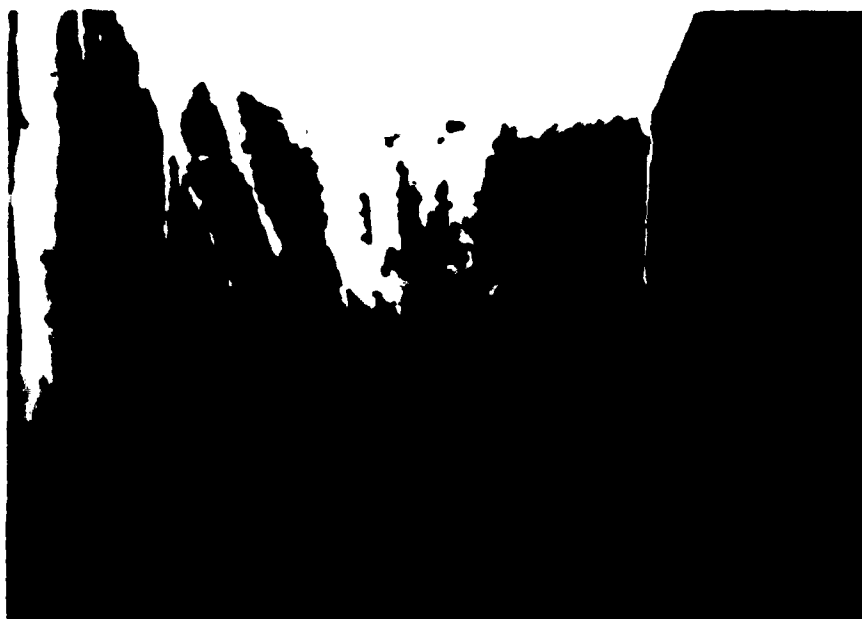
A-8A Crack in upstream face of spillway viewed from right training wall - 6/3/81



A-8B Deteriorated concrete of apron and base of right training wall 6/3/81



A-9A Upstream view of bay no. 7 of Ambursen spillway section  
6/3/81



A-9B Upstream view of bay no. 6 of Ambursen spillway section.  
Valves on outlet pipe are down behind concrete wall - 6/3/81



A-10A Valves on outlet pipe in bay no. 6 - 6/3/81



A-10B Downstream channel from left training wall. Note concrete apron in foreground at toe of spillway - 6/3/81

**APPENDIX B**  
**VISUAL INSPECTION CHECKLIST**

PHASE I  
VISUAL INSPECTION CHECKLIST

1. BASIC DATA

a. General

Name of Dam Black Creek Reservoir Dam  
Fed. I.D.# NY00182 DEC Dam No. 696  
River Basin MOHAWK  
Location: Town NORWAY County HERKIMER  
Stream Name BLACK CREEK  
Tributary of WEST CANADA CREEK (BLACK CREEK ENTERS AT HINCKLEY RESERVOIR)  
Latitude (N) 43° 15.3' Longitude (W) 74° 55.7'  
Type of Dam EARTH W/ AMBURSEN (CONCRETE BUTRESS) SPILLWAY SECTION  
Hazard Classification HIGH  
Date(s) of Inspection June 3, 1981  
Weather Conditions OVERCAST + WARM W/ RAIN SHOWERS TOWARD NOON  
Reservoir Level at Time of Inspection EL 1310 SPILLWAY CREST

b. Inspection Personnel (\*Recorder) THOMAS BENVEDUCCI - CTM,  
\* EDWIN VOPELAK JR - CTM, RONALD C. HIRSCHFELD\* - GEI

c. Persons Contacted (Including Title, Address & Phone No.)  
RUSSELL S. LOGALBO, PE., PRINCIPAL ENGINEER  
CITY OF UTICA BOARD OF WATER SUPPLY  
3RD FLOOR, 1 KENNEDY PLAZA UTICA, N.Y. 13502  
(315) 798-3316

d. History  
Date Constructed 1906 Date(s) Reconstructed \_\_\_\_\_  
Designer AMBURSEN HYDRAULIC CONSTRUCTION CO.  
Constructed By AMBURSEN HYDRAULIC CONSTRUCTION CO.  
Owner CITY OF UTICA BOARD OF WATER SUPPLY, P.O. BOX 345  
1 KENNEDY PLAZA, UTICA, NY 13502

ATTN: R.S. LOGALBO, PRINCIPAL ENGR. (315) 798-3316  
FREDERICK A. ALWITT, GEN. MGR (315) 798-3301

2. EMBANKMENT

## a. Characteristics

- GEI 1) Embankment Material Unknown
- GEI 2) Cutoff Type Unknown
- GEI 3) Impervious Core 16-inch wide concrete core wall  
at downstream edge of crest of embankment sections.
- GEI 4) Internal Drainage System Unknown
- GEI 5) Miscellaneous No comments

## GEI b. Crest

- GEI 1) Vertical Alignment Good
- GEI 2) Horizontal Alignment Good
- GEI 3) Lateral Movement No evidence of lateral  
movement observed.
- GEI 4) Surface Cracks None observed.
- GEI 5) Miscellaneous No comments.

## GEI c. Upstream Slope

- GEI 1) Slope (Estimate H:V) 2.5 H : 1 V
- GEI 2) Undesirable Growth or Debris, Animal Burrows Trees  
and brush growing on upstream slope
- GEI 3) Sloughing, Subsidence or Depressions No evidence  
of sloughing, subsidence or depressions  
observed

GEI 4) Slope Protection Riprap 12 to 18 inches in size.

GEI 5) Surface Cracks or Movement at Toe None observed

GEI d. Downstream Slope

GEI 1) Slope (Estimate - H:V) 2H: 1V

GEI 2) Undesirable Growth or Debris, Animal Burrows Trees and brush growing on downstream slope

GEI 3) Sloughing, Subsidence or Depressions No evidence of sloughing, subsidence, or depressions observed.

GEI 4) Surface Cracks or Movement at Toe None observed

GEI 5) Seepage None observed

GEI 6) External Drainage System (Ditches, Trenches, Blanket) None observed

GEI 7) Condition Around Outlet Structure Not applicable

GEI 8) Seepage Beyond Toe None observed

GEI e. Abutments - Embankment Contact

Dirt road crosses left abutment perpendicular to axis of dam

GEI 1) Erosion at Contact None observed

GEI 2) Seepage Along Contact None observed at left abutment.  
One soft, wet area with some rust-stained  
standing water at lower part of contact  
with right abutment.

3. DRAINAGE SYSTEM

GEI a. Description of System None observed

GEI b. Condition of System Not applicable

GEI c. Discharge from Drainage System Not applicable

4. INSTRUMENTATION (Monumentation/Surveys, Observation Wells, Weirs, Piezometers, Etc.)

None observed

5. RESERVOIR

GEI a. Slopes Low, flat, tree-covered slopes. No slope  
stability problems apparent.

GEI b. Sedimentation No evidence of significant  
sedimentation observed

GEI c. Unusual Conditions Which Affect Dam None observed

6. AREA DOWNSTREAM OF DAM

- a. Downstream Hazard (No. of Homes, Highways, etc.) BRIDGE W/ ROAD 300' ± DS, 1 1/2 MILES DS STREAM FLOWS THROUGH HAMLET OF GRAY WHERE SEVERAL DWELLINGS ARE LOCATED NEAR STREAM.
- GEI b. Seepage, Growth Erosion, apparently due to groundwater discharge, on left bank of downstream channel close to toe of embankment near training wall at left end of spillway.
- GEI c. Evidence of Movement Beyond Toe of Dam None observed
- d. Condition of Downstream Channel AS WIDE AS SPILLWAY (70' WIDE) NEAR DAM AND NARROWING DS. CHANNEL CONSISTED OF DEEPER OPENING ± ABOUT 70-80' ± WIDE DS OF DD DSG. HEAVY TREE GROWTH ALONG BANKS

7. SPILLWAY(S) (Including Discharge Channel)

- a. General CHUTE SPILLWAY IS IMPERSON (CONCRETE BUTTRESS) OVERFLOW SECTION W/ CONCRETE UP FACE & WOOD PLANK (4" x 6") DS FACE. LOG SLUICE 6' THRU SPILLWAY CREST, 8.5' WIDE NEAR RIGHT SIDE OF SPILLWAY, PRESENTLY STOPPED (CLOSED) SHUT. CONCRETE TRAINING WALLS & SPILLWAY CREST ARE KEPT TO TAKE CONCRETE IF SECTION WERE RAISED
- b. Condition of Service Spillway UP FACE (WHICH IS VISIBLE) - EROSION OF CONCRETE W/ EXPOSED AGGREGATE. DIAGONAL CRACK IN U/S FACE FROM SPILLWAY CREST 9' OUT SIDE DOWN INTO WATER WHICH IS 10' ± FROM LEFT TRAINING WALL - TILTS INTO SPILLWAY. 2 COUNTERFORTS JUST U/S OF WALL REMAINED FROM TRAINING WALL BY 2' TO 4'. CORE WALL SEPARATED FROM TRAINING WALL AT TOP BY 4". FIRST COUNTERFORT DS CORE WALL SEPARATED FROM TRAINING WALL BY 6" AT TOP. OTHER DS OF COUNTERFORTS FROM CORE WALL GOING INTO DISINTEGRATING CONCRETE & EXPOSED REBAR. CORE WALL & COUNTERFORTS MAY NOT HAVE REBAR AT THIS INTERSECTION W/ TRAINING WALL. CORE WALL SEPARATED FROM TOP OF WALL TO SPILLWAY CREST. LARGE SPALLING AREA EXPOSED REBAR AT SPILLWAY CREST / WALL CONTACT. AT DS END NEAR BOTTOM ALSO EXPOSED REBAR SPALLING OF WALL. LARGE DIAGONAL CRACK AT DS END EFFECT 1/2" TO 1" VERTICAL, HAS BEEN REPAIRED W/ NEW CONCRETE THAT WAS ADDED TO END OF WALL. ENTIRE LEFT WALL HAS STAINING ENCRUSTATION & CRACKING ALSO SPALLING ALONG TOP OF WALL. LAST COUNTERFORT DS, LEAVING UP. RIGHT TRAINING WALL - SECOND COUNTERFORT U/S FROM CREST WALL SEPARATED DIAGONALLY AT TOP, INTO WATER, & HELD TO REBAR. CRACK AT CORE WALL TRAINING WALL INTERFERENCE. ALL COUNTERFORTS DS OF CORE WALL SEPARATED AT TOP FROM WALL BY 2" TO 5". DS MOST COUNTERFORT BROKEN OFF FROM WALL & LEAVING DS BY 2" ON TOP. SOME REBAR & TRAINING COUNTERFORT & WALL INTERFERENCE. EXPOSED SPALLING & EROSION ALONG DS END OF WALL AT BOTTOM & REPAIRED AREA OF CONCRETE AT DS END. ENTIRE RIGHT WALL HAS SOME STAINING AND LINE CRACKING & ENCRUSTATION. SPALLING AREA AT WALL / SPILLWAY CREST CONTACT. (CONTINUED ON NEXT PAGE)

C. T. MALE ASSOCIATES, P.C.

ENGINEERS

SURVEYORS

ARCHITECTS

LANDSCAPE ARCHITECTS

PLANNERS

3000 TROY ROAD, SCHENECTADY, N.Y. 12309

(518) 783-0976

J.A.  
JOB BLACK CREEK RESERVOIR DAM

SHEET NO. VISUAL INSPECTION OF

CALCULATED BY

DATE JUNE 3, 1981

CHECKED BY

DATE

SCALE

7.b. CONDITION OF SERVICE SPILLWAY (CONT.)

PLANKING - BARE WOOD PLANKING IS WEATHERED, BUT PLANKS (4"x8") ALONG W/ THEIR TIMBER SUPPORTS ARE SOUND.

D/S ENDS OF BUTTRESSES - CONCRETE REPAIRS AT ENDS (PERFORMED 1974). CONCRETE STEP AT END OF 3 BAYS NEXT TO RIGHT TRAINING WALL IS ERODED + DETERIORATED ALONG ITS D/S EDGE.

INSIDE AMBURSEN SECTION (UNDERNEATH SPILLWAY) IN BAYS:

10 BAYS - WILL REFER TO BAYS AS 1 TO 10 FROM LEFT TO RIGHT, LOOKING D/S.

- BAYS 1+2 - NO ACCESS.
- BAYS 9+10 - U/S SIDE UNDER SPILLWAY DECK, NO ACCESS
- BAYS 3 TO 6 - BOTTOM OF BAYS, ESPECIALLY U/S ENDS, OBSCURED BY FLOW FROM OUTLET PIPES
- BAYS 7+8 - VISIBLE ALTHOUGH WATER OBSCURED U/S ENDS

- GENERAL CONDITION OF OBSERVABLE PORTIONS OF ALL BAYS.

VISIBLE CONCRETE APPEARS TO BE IN GOOD CONDITION. SOME WEAR OF CONCRETE SURFACES TO DUE WEATHERING. STALAGMITES OF CALCIUM CARBONATE + EFFLORESCENCE AT INTERSECTIONS OF CONCRETE SURFACES + CONSTRUCTION JOINTS. ALSO RANDOM PATCHES ON CONCRETE. NO LEAKAGE WAS OBSERVED IN AREAS THAT WERE VISIBLE. IT IS SUSPECTED THAT CONCRETE AT BOTTOM OF BAYS (ESPECIALLY OUTLET PIPE BAYS) MAY SHOW SIGNS OF DAMAGE DUE TO ICE ACTION, THE WATER IN BAYS OBSCURES LOWEST CONCRETE SURFACES.

- IN GENERAL, THE INSIDE OF THE AMBURSEN SECTION COULD NOT BE THOROUGHLY INSPECTED DUE TO POOR LIGHTING, LACK OF ACCESS, + FLOWING WATER FROM OUTLET PIPES WHICH OBSCURES CONCRETE.

Name of Dam Black Creek Reservoir Dam Date June 3, 1981 6

- d. Condition of Discharge Channel 20' CONC. PAVED AREA (MADE OF BROUDED STONE) DIS OF PLANK PORTION OF SPILLWAY SURFACE IS CRACKED & WORN DUE TO WATER ACTION. END IS 2' HIGHER THAN NATURAL STREAM CHANNEL. ABOUT 50' WIDE. SECTION ON RIGHT SIDE IS CRACKED & BROUDED STONE TO 10". AREA 5 FEET 1" LONGER THAN REMAINDER OF CHANNEL. THIS AREA IS CURRENTLY SPALLED W/ SEVERAL HOLES W/ FACING.

8. RESERVOIR DRAIN/OUTLET

- a. Type: Pipe ☒ Conduit \_\_\_\_\_ Other \_\_\_\_\_
- b. Material: Concrete \_\_\_\_\_ Metal ☒ Other \_\_\_\_\_
- c. Size: 4-21" DIAMETER PIPES Length 13' 2"
- d. Invert Elevations: Entrance 1293 Exit 1293
- e. Physical Condition (Describe)

SEE H+H  
DATA  
CHECKLIST  
APPENDIX CUnobservable ☒1) Material CONCRETE PIPES W/ JOINTS NOT LOCATED BY RECORD, AT JOINTS OF PIPES THERE IS NO EVIDENCE OF WATER SEEPAGE

2) Joints \_\_\_\_\_ Alignment \_\_\_\_\_

3) Structural Integrity \_\_\_\_\_

4) Hydraulic Capability GOOD. APPARENTLY THEY ARE OPEN FULL EACH YEAR IN SPRINGf. Means of Control: Gate \_\_\_\_\_ Valve ☒ Uncontrolled \_\_\_\_\_Operation: Operable ☒ Inoperable \_\_\_\_\_ Other \_\_\_\_\_Present Condition (Describe) 2 VALVES IN SERIES ON OUTLET IN DAMS. VALVES ARE RUSTY & DIFFICULT TO OPERATE BY 2 MEN W/ A LITTLE LEVERAGE. WOOD PLANKS USED AS LEVER TO VALVES.

g. Other Outlets (water mains, diversion pipes) \_\_\_\_\_

N/A

9. STRUCTURALa. Concrete Surfaces Concrete surfaces are in good condition. No visible cracks or spalls.Concrete surfaces are in good condition. No visible cracks or spalls.Concrete surfaces are in good condition. No visible cracks or spalls.Concrete surfaces are in good condition. No visible cracks or spalls.b. Structural Cracking No structural cracking observed. No visible cracks or spalls.No structural cracking observed. No visible cracks or spalls.No structural cracking observed. No visible cracks or spalls.c. Movement - Horizontal & Vertical Alignment (Settlement) No movement observed. No visible cracks or spalls.No movement observed. No visible cracks or spalls.No movement observed. No visible cracks or spalls.No movement observed. No visible cracks or spalls.GEI d. Junctions with Abutments or Embankments Good conditionGood conditionGood conditionGood conditionGEI e. Drains - Foundation, Joint, Face None observedNone observedNone observedNone observedf. Water Passages, Conduits, Sluices Low water level in spillwayLow water level in spillwayLow water level in spillwayLow water level in spillwayGEI g. Seepage or Leakage None observedNone observedNone observedNone observed

0798

Name of Dam Black Creek Reservoir Dam Date June 3, 1981 8

h. Joints - Construction, etc. CONCRETE/STEEL JOINTS  
ALL SOL - MANY DISLOCATIONS AND CRACKS IN REINFC  
ACCESS JOINTS - CALCIUM CARBONATE PREDEPOSITED & DEPOSITED  
AT JOINTS INSIDE R.A. JOINT SECTION.

CEL 1. Foundation *Not visible*

GEI J. Abutments Concrete training walls between spillway section and cantilevered sections

### k. Control Gates

ACVF

1. Approach & Outlet Channels DESIGNED TO FULL UTILIZATION

RECEIVED  
JAN 12 1964

ENDS OF DITCHES - Generally are not to be used for  
flow measuring. Flow should be measured in a ditch 100 ft or more from stream

#### n. Energy Dissipators (Plunge Pool, etc.)

Exhibit A-1 (S' + D) = 0.00

AREA OF DECK AND OF PLANKED CHUTE OF BRIDGE

## n. Intake Structures

~~NOT CREATABLE~~

### **o. Stability**

p. Miscellaneous

10. APPURTENANT STRUCTURES (Power House, Lock, Gatehouse, Service Bridge, Other)

## a. Description:

OLD SPILLWAY ACCESS SHAFT - CONCRETE SHAFT 45' AT CORNER  
NEXT TO FRONT TRAINING WALL OF SPILLWAY

SHALL BE ACCESS PATH - DOUBLE DOOR WITH WOODEN PLAT AT BOTTOM  
ON OR DEPEND ON IT.

SPILLWAY WALKWAY - WOODEN WALKWAY 2' OFF BOTTOM OF SPILLWAY  
FLOOR IS OLD ACCESS SHAFT TO INCLUDING EXT 3.

## b. Condition:

OLD SPILLWAY ACCESS SHAFT - TAKEN A CORNER AT ALL 4 CORNERS  
ON A WOODEN PLATE WITH A PLATE  
ON EACH CORNER TO BE USED OVER  
ON EACH CORNER TO BE USED OVER

SPILLWAY ACCESS PATH - WOODEN PLATE, NOT USED, BUT ACCESS  
ON OR DEPEND ON IT.

SOUND WALKWAY - GOOD WOOD. TAKEN A CORNER AT ALL 4 CORNERS  
ON A WOODEN PLATE WITH A PLATE

11. MISCELLANEOUS MECHANICAL/ELECTRICAL EQUIPMENTa. Description: SHALL BE ON FRONT TRAINING WALL

WOODEN PLATE WITH DRAIN VALVES ON EACH CORNER  
THE OUTLET PIPES

b. Condition: ALL MEC. MECHANICAL EQUIPMENT IS NOT USED  
IN STATE OF DISREPAIR12. OTHER

## APPENDIX C

## HYDROLOGIC AND HYDRAULIC ENGINEERING DATA

## CHECKLIST AND COMPUTATIONS

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PHASE I INSPECTION  
HYDROLOGIC AND HYDRAULIC  
ENGINEERING DATA CHECKLIST

Name of Dam P. LACK CREEK RESERVOIR DAM Fed. Id. # NY 00122

1. AREA-CAPACITY DATA

	<u>Elevation</u> (ft.)	<u>Surface Area</u> (acres)	<u>Storage Capacity</u> (ac-ft.)
a. Top of Dam	<u>1316</u>	<u>431.3</u>	<u>5848</u>
b. Design High Water (Max. Design Pool)	<u>UNKNOWN</u>		
c. Auxiliary Spillway Crest	<u>N/A</u>		
d. Pool Level with Flashboards	<u>N/A</u>		
e. <del>Service</del> Spillway Crest	<u>1310</u>	<u>322.7</u>	<u>3524</u>
f. LOG SLUICE (w/ 2.2' W.S. REMOVED)	<u>1304</u>		

2. DISCHARGES

	<u>Volume</u> (cfs)
a. Average Daily (ESTIMATED AS ONE OUTLET PIPE FULLY OPEN + W.S. @ SPILLWAY CREST)	<u>80</u> EST.
b. Spillway @ Top of Dam	<u>4,490</u>
c. Spillway @ Design High Water	<u>UNKNOWN</u>
d. Service Spillway @ Auxiliary Spillway Crest Elevation	<u>N/A</u>
e. Low Level Outlet (ALL 4 NORMALLY PARTIALLY OPEN, ESTIMATED FLOW IS ABOUT 90 cfs W/ W.S. @ TOP OF DAM OR FLOW OF ONE PIPE FULL OPEN)	<u>90</u>
f. Total (of all facilities) @ Top of Dam *	<u>4,580</u> (SAY 4,600)
g. Maximum Known Flood (5/3/14 - 2.2' OVER SPILLWAY CREST)	<u>1,000</u>
h. At Time of Inspection (6/4/81 EST. AS ONE OUTLET PIPE FULLY OPEN + W.S. @ SPILLWAY CREST)	<u>80</u> EST.

\* EXCLUDES LOG SLUICE WHICH IS ALWAYS STOP LOGGED UP TO  
SPILLWAY CREST, EL 1310.

4596

3. TOP OF DAM

Elevation 1316

- a. Type EARTH W/ AMBURSEN (CONCRETE BUTRESS) SPILLWAY SECTION  
b. Width 25' Length 385 (INCLUDING SPILLWAY)  
c. Spillover OVERFLOW SPILLWAY  
d. Location NEAR WEST SIDE OF DAM LOOKING D/S

4. SPILLWAY

SERVICE

AUXILIARY

- a. 1310 Elevation N/A  
b. OVERFLOW Type \_\_\_\_\_  
c. 99' \* Width \_\_\_\_\_  
d. ✓ Type of Control Uncontrolled \_\_\_\_\_  
Controlled:  
e. \_\_\_\_\_ Type \_\_\_\_\_  
(Flashboards; gate)  
f. \_\_\_\_\_ Number \_\_\_\_\_  
g. \_\_\_\_\_ Size/Length \_\_\_\_\_  
4' x 8' WOODEN  
h. PLANKING Invert Material \_\_\_\_\_  
i. \_\_\_\_\_ Anticipated Length of Operating Service \_\_\_\_\_  
j. 50' ± Chute Length \_\_\_\_\_  
k. 30' BUT 1/3 FACE Height Between Spillway Crest \_\_\_\_\_  
SLOPES UP TO CREST & Approach Channel Invert  
(Weir Flow)  
l. \_\_\_\_\_ Other \_\_\_\_\_  
\_\_\_\_\_

\* INCLUDES LENGTH ABOVE LOG SLUICE. SLUICE HAS 8.6' CLEAR  
OPENING, BOTTOM EL 1304, + IS PRESENTLY STOP LOGGED  
SHUT UP TO SPILLWAY CREST, EL 1310.

4597

5. OUTLET STRUCTURES/EMERGENCY DRAWDOWN FACILITIES

- a. Type: Gate \_\_\_\_\_ Sluice \_\_\_\_\_ Conduit ☒ Penstock \_\_\_\_\_
- b. Shape 4 CAST IRON PIPES, 3 W/ 2 VALVES ON END & 1 W/ 1 VALVE
- c. Size 24" DIAMETER 13' LONG
- d. Elevations: Entrance Invert 1283 EST  
Exit Invert 1283
- e. Tailrace Channel: Elevation 1282 ±

6. FLOOD WATER CONTROL SYSTEM

- a. Warning System NONE
- b. Method of Controlled Releases (mechanisms) \_\_\_\_\_  
THE 4 OUTLET PIPE HAVE VALVES WHICH CAN BE OPERATED

7. CLIMATOLOGICAL GAGES REFERENCES 21+22

- a. Type NON-RECORDING PRECIPITATION & TEMPERATURE GAGE INDEX # 3989
- b. Location HINCKLEY NY LAT. 43° 19' LONG. 75° 07' ~ 41. NW OF DAM
- c. Period of Record 1917 TO PRESENT (PRECIPITATION ONLY)
- d. Maximum Reading UNKNOWN Date \_\_\_\_\_

8. STREAM GAGES REFERENCE 23

- a. Type WATER-STAGE RECORDER \* USGS GAGE # 01346000
- b. Location WEST CANADA CREEK AT CAST BRIDGE, NY  
LAT. 43° 04' 04", LONG. 74° 59' 26" ~ 13 MILES SOUTH OF DAM
- c. Period of Record CONTINUOUS FROM 1920 TO PRESENT, OTHERS FROM 1913
- d. Maximum Reading 23,300 cfs = 41.9 cfm Date MARCH 26, 1913

9. OTHER \* HINCKLEY RESERVOIR LOCATED U/S

10. DRAINAGE BASIN CHARACTERISTICS

- a. Drainage Area 23.99 SQUARE MILES (15354.6 ACRES)
- b. Land Use - Type FOREST
- c. Terrain - Relief SLOPES OF FROM 5% TO 10%
- d. Surface - Soil GLACIAL TILL
- e. Runoff Potential (existing or planned extensive alterations to existing surface or subsurface conditions)

NONE KNOWN.

- f. Potential Sedimentation Problem Areas (natural or man-made; present or future)

NONE KNOWN.

- g. Potential Backwater Problem Areas for Levels at Maximum Storage Capacity (including surcharge storage)

NONE KNOWN.

- h. Dikes - Floodwalls (overflow & non-overflow) - Low Reaches Along the Reservoir perimeter

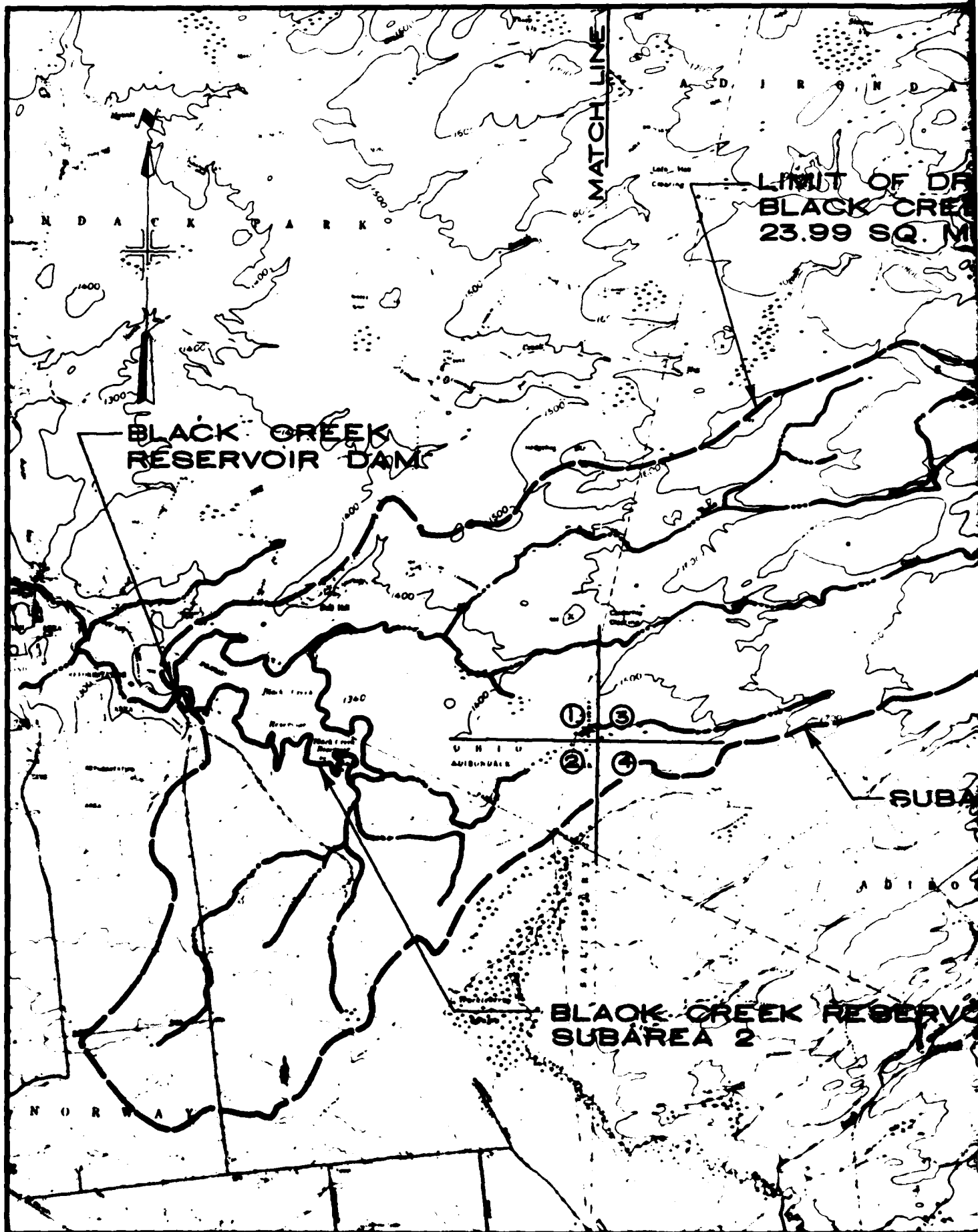
Location N/A

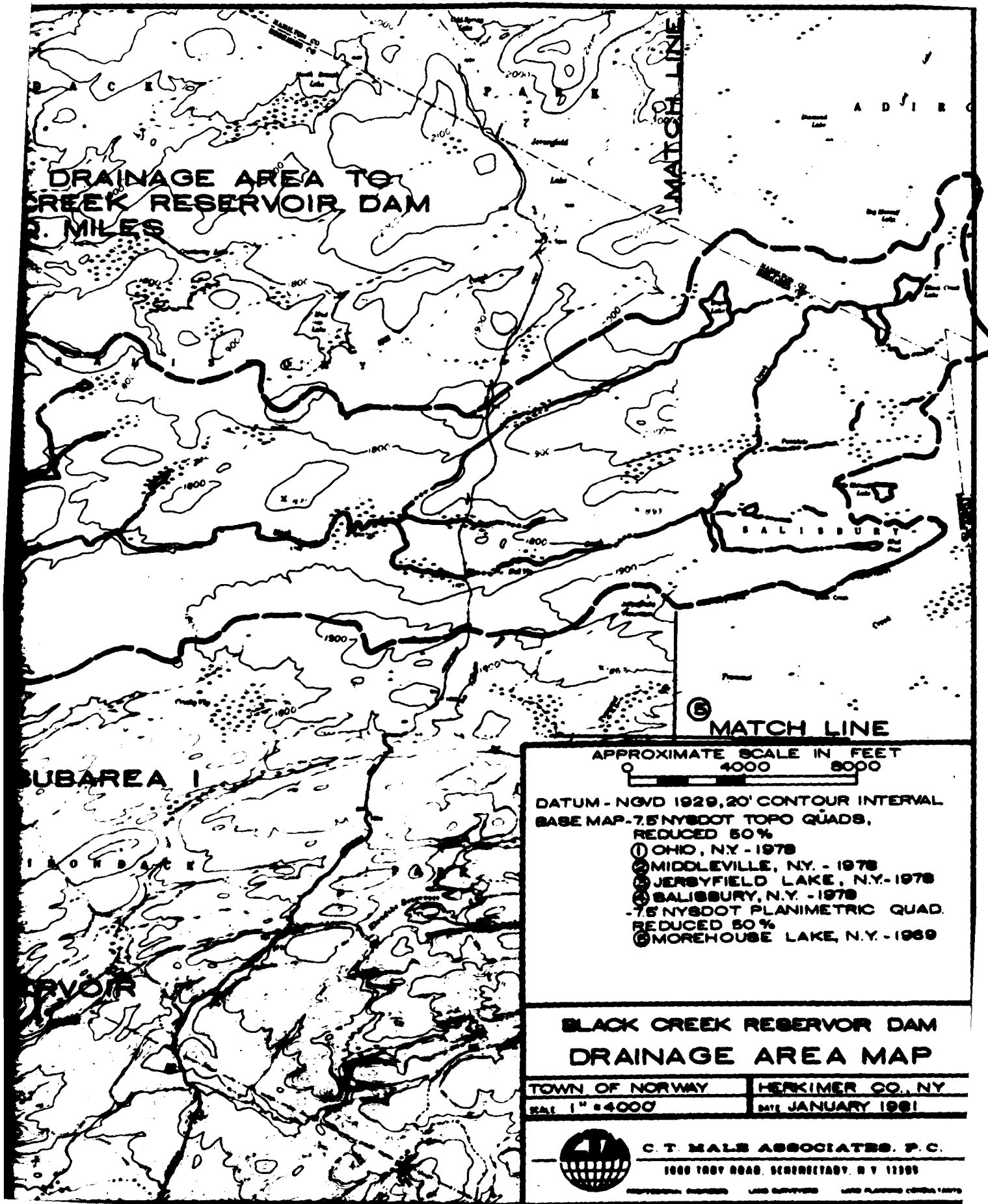
Elevation \_\_\_\_\_

- i. Reservoir

Length @ <sup>SPILLWAY CREST</sup> ~~Maximum Design~~ Pool 8000' + (feet)

Length of Shoreline (@ ~~Service~~ Spillway Crest) 25000 ± (feet)





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COMPUTER SERVICES LANDSCAPE ARCHITECTURE LABORATORY SERVICES

JOB BLACK CREEK RESERVOIR DAM

SHEET NO. \_\_\_\_\_ OF \_\_\_\_\_

CALCULATED BY CLV DATE 6/16/81

CHECKED BY JMR DATE 8/18/81

SCALE 80.00845

DRAINAGE AREAS

	AREA (acres)	AREA (square miles)
WATERSHED TO BLACK CREEK RESERVOIR (SUBAREA 1)	15031.9	23.487
BLACK CREEK RESERVOIR SURFACE (SUBAREA 2) @ SPILLWAY CREST EL=1310	322.7	0.504
TOTAL DRAINAGE AREA TO BLACK CREEK RESERVOIR DAM	15354.6	23.991

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LANDSCAPE ARCHITECTURE

LABORATORY SERVICES

JOB BLACK CREEK RESERVOIR DATA

SHEET NO

OF

CALCULATED BY

CLV

DATE

6/16/81

CHECKED BY

JTB

DATE

8/18/81

SCALE

80,00845

### DRAINAGE AREA DATA FOR HEC-1DB MODEL

SUBAREA 1: AREA TRIBUTARY DIRECTLY TO RESERVOIR

AREA = 23.487 SQUARE MILES

LOSS RATES: 1.0" - INITIALLY

0.1"/HOUR - CONSTANT LOSS RATE

UNIT HYDROGRAPH PARAMETERS: USE SNYDER METHOD

A = DRAINAGE AREA = 23.487 SQUARE MILES

L = LENGTH OF MAIN WATERCOURSE TO UPSTREAM LIMIT OF DRAINAGE AREA = 11.93 MILES

$L_{CA}$  = LENGTH ALONG MAIN WATERCOURSE TO POINT OPPOSITE THE CENTROID OF THE DRAINAGE AREA = 3.98 MILES

$C_s$  = SNYDER'S BASIN COEFFICIENT = 2.0 ASSUMED AVERAGE

$C_p$  = SNYDER'S PEAKING COEFFICIENT = .68 (FROM REF. 20)

$\tau_p$  = STANDARD LAG IN HOURS =  $C_s(L + L_{CA})^{0.3} = 6.37$  HOURS

$$\tau_p = \frac{\tau_p}{C_s} = \frac{6.37}{2.0} = 3.185 = 1.16 \text{ HR MAX}$$

$\therefore$  USE  $\tau_p = 6.4$  HOURS

USE  $\tau_p' = 10 \text{ min} < 1.16 \text{ HR}$  OK

SUBAREA 2: RESERVOIR SURFACE, AREA = 0.504 SQUARE MILES (322.7 ACRES)

LOSS RATES: NONE BECAUSE RAINFALL  $\approx$  RUNOFF FOR WATER SURFACE

UNIT HYDROGRAPH PARAMETERS:

FOR U.H. W/ 10 MINUTE DURATION  $\neq$  1" RAIN

$$\bar{Q} = \frac{A(1")}{\tau} = \frac{322.7 \text{ acres}(1")}{10 \text{ minutes}} \left( \frac{43560 \text{ SQ. FT.}}{1 \text{ acre}} \right) \left( \frac{1 \text{ FT}}{12 \text{ inches}} \right) \left( \frac{1 \text{ minute}}{60 \text{ seconds}} \right)$$

$$\bar{Q} = 1,952 \text{ cfs} \quad (\text{W/O LOSS RATE})$$

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JOB BLACK CREEK RESERVOIR DAM

SHEET NO. OF  
CALCULATED BY CLV DATE 6/16/81  
CHECKED BY YR DATE 8/18/81  
SCALE 80.008.45

## ELEVATION - AREA - STORAGE COMPUTATIONS

RESERVOIR VOLUME : FROM DATA COMPUTED BY A. LASHURE, FOR CITY OF UTICA BOARD OF WATER SUPPLY (1975). FORMULA USED WAS  
 $V = \frac{1}{2} D (A - A_1) + D (A_1)$ . SEE APPENDIX F3-80.

### INPUT

	ELEVATION (NGVD - ft.)	AREA (acres)	V <sub>T</sub> (acre-feet)
OUTLET PIPES	1282	0	0
↳ 1283	1284	.06	.1
	1286	7.80	7.9
	1290	45.50	96.5
	1294	90.42	370.2
	1298	146.64	834.3
	1302	200.86	1532.0
	1306	252.82	2439.9
SPILLWAY CREST	1310	322.73	3583.7 (3584)
	1312	362.17	4268.6
	1314	392.84	5023.6
TOP OF DAM	1316 (1)	431.29	5847.8 (5848)
	1318	480.04	6759.1
	1320	538.29	7777.4
	1322	584.00	8899.7
	1323	609.56	9496.5

(1) DISTANCE FROM SPILLWAY CREST TO TOP OF DAM MEASURED IN FIELD.

Fr-CTN 105

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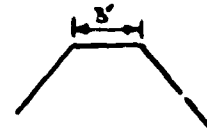
(518) 783-0970

JOB BLACK CREEK RESERVOIR DAM

SHEET NO. OF  
CALCULATED BY CLV DATE 6/16/81  
CHECKED BY JMA DATE 8/18/81  
SCALE 80.00845

## DISCHARGE COMPUTATIONS

SPILLWAY WEIR CREST



DAM APPURTENANCE	ELEVATION (NGVD)	SIZE
SPILLWAY	CREST EL = 1310	99' CREST LENGTH (INCLUDING LOG SLUICE)
DAM	TOP OF DAM EL = 1316	286' CREST LENGTH (EXCLUDING SPILLWAY)
LOG SLUICE	INVERT EL = 1304 (W/O STOP LOGS)	8.6' CLEAR OPENING
LOW LEVEL OUTLETS	INVERT F.L. = 1283 E.L. = 1284	4 - 24" CIP $A = \pi r^2 = 8.1'$ $A = 3.14'$

FOR SPILLWAY:  $Q = 3.087 L H^{1.5}$   
INPUT

(APPROXIMATED W/ FORMULA FOR  
CRITICAL FLOW OVER IDEAL BROAD-  
CRESTED WEIR, W/O ABUTMENT CONTRACTION  
SEE REF. 9)

FOR DAM:  $Q = 2.9 L H^{1.5}$   
INPUT

(FORMULA FOR CRITICAL FLOW OVER BROAD-CRESTED  
WEIR, REF. 9. WEIR CREST PROVIDED TO ALLOW FOR  
FREE CUP WITH ON W/S SLOPE - TOP OF DAM)

FOR LOW LEVEL OUTLETS:  $Q = 0.6 A \sqrt{2gh}$  (FORMULA FOR CRITICAL FLOW THROUGH  
PIPE W/ FREE DISCHARGE SEE REF. 9)

\* NORMALLY VALVES ON EACH LOW LEVEL OUTLET ARE OPENED 5 TURNS.

PIPE CAPACITY FOR THIS CASE IS UNKNOWN. THEREFORE FOR THE  
PURPOSES OF THIS ANALYSIS IT WAS ASSUMED THAT ONE VALVED  
PIPE WAS COMPLETELY OPEN + OTHER 3 ARE COMPLETELY CLOSED.

	ELEVATION (NGVD)	(1) h (ft)	H <sub>spillway</sub> (ft)	H <sub>dam</sub> (ft)	Q <sub>OUTLET</sub> (cfs)	Q <sub>PIPE</sub> (cfs)	Q <sub>SPILLWAY</sub> (cfs)	Q <sub>DAM</sub> (cfs)	Q <sub>TOTAL</sub> (cfs)
SPILLWAY CREST	1310	26	0	0	77 (say 80)	0	0	0	77
	1312	28	2	0	80		864	0	944
	1314	30	4	0	83		2145	0	2528
TOP OF DAM	1316	32	6	0	86 (say 90)		4492 (say 4490)	0	4580 (say 4580)
	1318	34	8	2	88		6915	2346	9349
	1320	36	10	4	91		9664	6635	16390
	1322	38	12	6	93	0	12704	12190	24987

(1) HEIGHT FROM & OF OUTLET PIPE TO WATER SURFACE.

(2) STOP LOGS IN PLACE UP TO SPILLWAY CREST, EL 1310. SLUICE INCLUDED  
IN SPILLWAY LENGTH ABOVE EL 1310. C-9

[illegible]



NO.	NAME	DATE	CHG	SSN	COMP	NO.	NAME	DATE	CHG	SSN
1	JOHN	12-15	100	12345	100	2	JOHN	12-15	100	12345
3	JOHN	12-15	100	12345	100	4	JOHN	12-15	100	12345
5	JOHN	12-15	100	12345	100	6	JOHN	12-15	100	12345
7	JOHN	12-15	100	12345	100	8	JOHN	12-15	100	12345
9	JOHN	12-15	100	12345	100	10	JOHN	12-15	100	12345
11	JOHN	12-15	100	12345	100	12	JOHN	12-15	100	12345
13	JOHN	12-15	100	12345	100	14	JOHN	12-15	100	12345
15	JOHN	12-15	100	12345	100	16	JOHN	12-15	100	12345
17	JOHN	12-15	100	12345	100	18	JOHN	12-15	100	12345
19	JOHN	12-15	100	12345	100	20	JOHN	12-15	100	12345
21	JOHN	12-15	100	12345	100	22	JOHN	12-15	100	12345
23	JOHN	12-15	100	12345	100	24	JOHN	12-15	100	12345
25	JOHN	12-15	100	12345	100	26	JOHN	12-15	100	12345
27	JOHN	12-15	100	12345	100	28	JOHN	12-15	100	12345
29	JOHN	12-15	100	12345	100	30	JOHN	12-15	100	12345
31	JOHN	12-15	100	12345	100	32	JOHN	12-15	100	12345
33	JOHN	12-15	100	12345	100	34	JOHN	12-15	100	12345
35	JOHN	12-15	100	12345	100	36	JOHN	12-15	100	12345
37	JOHN	12-15	100	12345	100	38	JOHN	12-15	100	12345
39	JOHN	12-15	100	12345	100	40	JOHN	12-15	100	12345
41	JOHN	12-15	100	12345	100	42	JOHN	12-15	100	12345
43	JOHN	12-15	100	12345	100	44	JOHN	12-15	100	12345
45	JOHN	12-15	100	12345	100	46	JOHN	12-15	100	12345
47	JOHN	12-15	100	12345	100	48	JOHN	12-15	100	12345
49	JOHN	12-15	100	12345	100	50	JOHN	12-15	100	12345
51	JOHN	12-15	100	12345	100	52	JOHN	12-15	100	12345
53	JOHN	12-15	100	12345	100	54	JOHN	12-15	100	12345
55	JOHN	12-15	100	12345	100	56	JOHN	12-15	100	12345
57	JOHN	12-15	100	12345	100	58	JOHN	12-15	100	12345
59	JOHN	12-15	100	12345	100	60	JOHN	12-15	100	12345
61	JOHN	12-15	100	12345	100	62	JOHN	12-15	100	12345
63	JOHN	12-15	100	12345	100	64	JOHN	12-15	100	12345
65	JOHN	12-15	100	12345	100	66	JOHN	12-15	100	12345
67	JOHN	12-15	100	12345	100	68	JOHN	12-15	100	12345
69	JOHN	12-15	100	12345	100	70	JOHN	12-15	100	12345
71	JOHN	12-15	100	12345	100	72	JOHN	12-15	100	12345
73	JOHN	12-15	100							

ELEVATION= 1282. 1284. 1286. 1290. 1294. 1298. 1302. 1306. 1310. 1312.  
 1314. 1316. 1318. 1320. 1322. 1323. 1325. 1326. 1327. 1328.

CREL SP-ID 99.0 3.1 1.5 1284.0 0.5 3.1 0.5  
 1310.0 99.0 3.1 1.5 1284.0 0.5 3.1 0.5

DAM DATA  
 IGREL 1000 EXFO DAM-ID  
 1316.0 2.9 1.2 286.

PEAK OUTFLOW IS 21012. AT TIME 46.83 HOURS

PEAK FLOW AND STORAGE (END OF PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS  
 FLOWS IN CUBIC FEET PER SECOND (CUBIC METERS PER SECOND)  
 AREA IN SQUARE MILES (SQUARE KILOMETERS)

RATIOS APPLIED TO FLOWS

OPERATION	STATION	AREA	PLAN	RATIO	1	RATIO	2
					1.00		0.50
HYDROGRAPH AT	SA-1	23.49 ( 60.83)	1	23963. ( 678.57)	11982. ( 339.28)		
HYDROGRAPH AT	SA-2	0.50 ( 1.31)	1	5359. ( 150.32)	2654. ( 75.16)		
2 COMBINED	SA-2C	23.99 ( 62.14)	1	24016. ( 680.05)	12008. ( 340.02)		
ROUTED TO	RES	23.99 ( 62.14)	1	21812. ( 617.64)	9973. ( 282.41)		

# SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1 .....

INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
1316.00	1310.00	1316.00
3584.	3584.	3584.
77.	77.	4377.

LLEAVATION
STORAGE
OUTFLOW

RATIO OF PMF	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
1.00	5.30	8505.	2142.	6.33	46.83	6.00
0.50	2.20	6561.	9973.	4.17	47.50	5.00

STATION	RES									
	INFLW(1)	OUTFLOW(0)	AND OBSERVED FLOW(1)	8000.	12000.	16000.	20000.	24000.	0.	0.
14-10226.	0	1								
14-10229.	0	1								
14-10230.	0	1								
14-10231.	0	1								
14-10232.	0	1								
14-10233.	0	1								
14-10234.	0	1								
14-10235.	0	1								
14-10236.	0	1								
14-10237.	0	1								
14-10238.	0	1								
14-10239.	0	1								
14-10240.	0	1								
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14-10262.	0	1								
14-10263.	0	1								
14-10264.	0	1								
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14-10277.	0	1								
14-10278.	0	1								
14-10279.	0	1								
14-10280.	0	1								
14-10281.	0	1								
14-10282.	0	1								
14-10283.	0	1								
14-10284.	0	1								
14-10285.	0	1								
14-10286.	0	1								

PMF

STATION RES

INFLOW(I),	OUTFLOW(O)	AND OBSERVED FLOW(O)
-	6000.	8000. 10000. 12000.

1/2 PMF

I

APPENDIX D  
STABILITY ANALYSIS

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JOB BLACK CREEK RES. DAMSHEET NO. 1OF 16CALCULATED BY JTBDATE 8/19/81CHECKED BY F. J. CurranDATE 8/24/81SCALE NoneSTABILITY ANALYSIS OF AMBURSFN SPILLWAY SECTION

CROSS SECTION FOR ANALYSIS - Typical buttress based on dwgs. Appendices G-1 & G-3 with G-3 (latest one) given more weight, & on visual observations. See section on sheet 2. Section is entire width of buttress with all the loads of one entire bay acting on the buttress.

Dead

Horiz. Moment

Load	Volume	Unit Wt.	=	W	x	arm about toe	=	M
W <sub>1</sub>	5.4 x 10 x 1.33 x	0.150 k/cf	=	10.77	x	(5.4/2) + 42	=	481.55
W <sub>2</sub>	5.4 x 9.5 x 1.67 x	"	=	12.85	x	" + "	=	574.42
W <sub>3</sub>	5.4 x 6.5 x 2 x	"	=	10.53	x	" + "	=	470.69
W <sub>4</sub>	1/2 x 13.44 x 10 x 1.33 x	"	=	13.41	x	(13.44/3) + 47.4	=	695.52
W <sub>5</sub>	13.44 x 9.5 x 1.67 x	"	=	31.98	x	(13.44/2) + 47.4	=	1730.97
W <sub>6</sub>	1/2 x 12.77 x 9.5 x 1.67 x	"	=	15.19	x	(12.77/3) + 60.84	=	989.12
W <sub>7</sub>	26.21 x 6.5 x 2 x	"	=	51.11	x	(26.21/2) + 47.4	=	3092.38
W <sub>8</sub>	2.39 x 5.5 x 2 x	"	=	3.94	x	(2.39/2) + 73.61	=	294.99
W <sub>9</sub>	4 x 4 x 1.33 x	"	=	3.19	x	(4/2) + 38	=	127.68
W <sub>10</sub>	8 x 2 x 1.33 x	"	=	3.19	x	(8/2) + 34	=	121.30
W <sub>11</sub>	8 x 9.5 x 1.67 x	"	=	19.04	x	(8/2) + 34	=	723.44
W <sub>12</sub>	4 x 7.5 x 1.67 x	"	=	7.52	x	(4/2) + 30	=	240.48
W <sub>13</sub>	4 x 3.5 x 1.67 x	"	=	3.51	x	(4/2) + 26	=	98.20
W <sub>14</sub>	4 x 2 x 1.67 x	"	=	2.00	x	(4/2) + 22	=	48.10
W <sub>15</sub>	20 x 6.5 x 2 x	"	=	39.00	x	(20/2) + 22	=	1248.00
W <sub>16</sub>	4 x 4 x 2 x	"	=	4.80	x	(4/2) + 18	=	96.00
W <sub>17</sub>	1/2 x 18 x 2.5 x 2 x	"	=	6.75	x	18 x 2/3	=	81.00
W <sub>18</sub>	18 x 1.5 x 2 x	"	=	8.10	x	18/2	=	72.90
Buttress Subtotal				246.88 k				11186.74 Ftk
W <sub>19</sub>	80 x 1.5 x 10 x	"	=	180.00	x	80/2	=	7200.00
W <sub>20</sub>	4 x 4.5 x 10 x	"	=	27.00	x	4/2 + 76	=	2106.00
W <sub>21</sub>	1 x 35.7 x 10 x	"	=	53.55	x	(28.6/2) + 47.4	=	3304.04
W <sub>22</sub>	2 x 4 x 10 x	"	=	12.00	x	(4/2) + 43.4	=	544.80
Floor & u/s Fike ST				272.55 k				13154.84 Ftk
& Top				D-1				

**(518) 785-0976**

JOB - BLACK CREEK RES. DAM.

**SHEET NO**

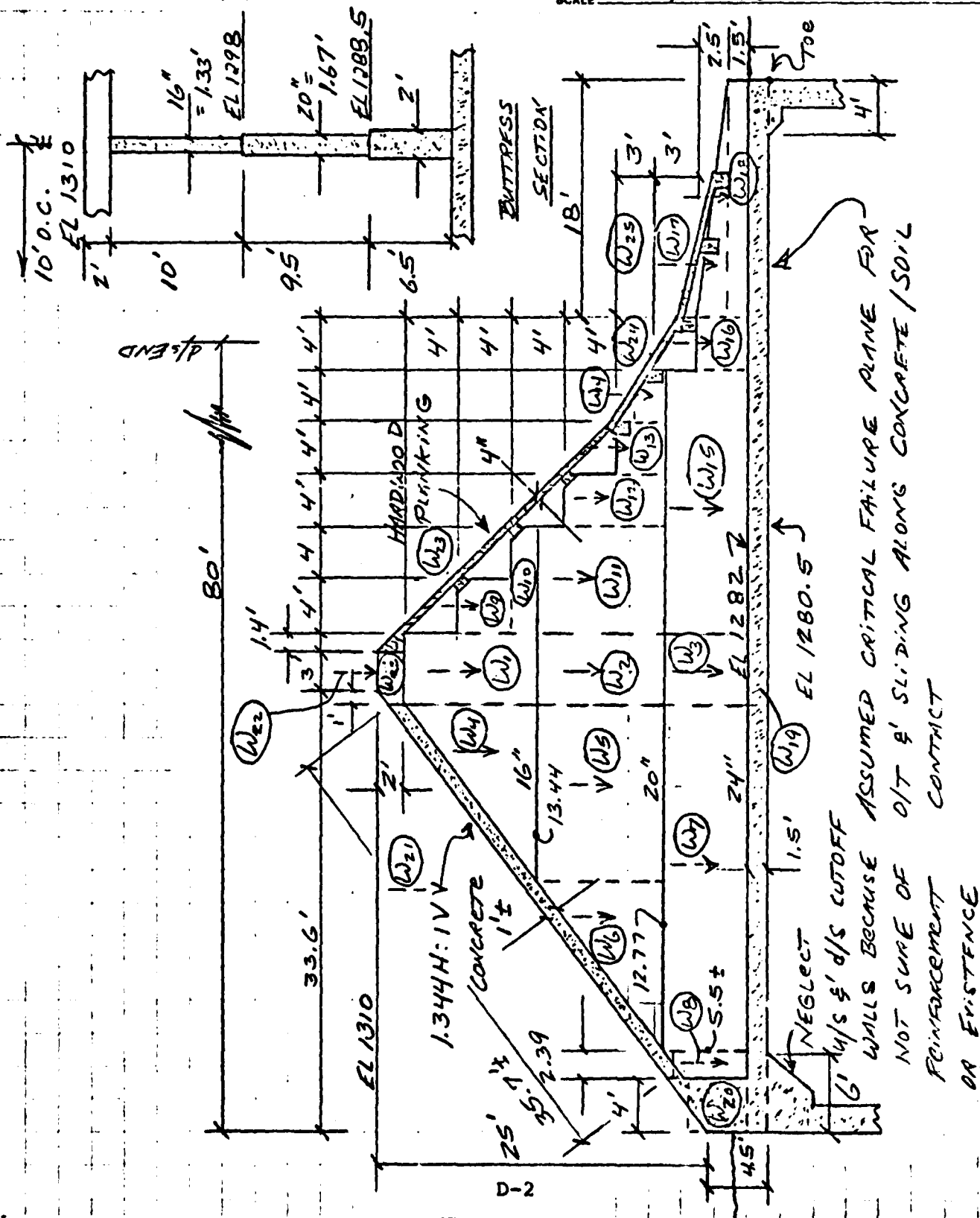
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**CALCULATED BY**

DATE \_\_\_\_\_

**CHECKED BY**

DATE \_\_\_\_\_

**SCALE**

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JOB BLACK CREEK RES. DAM

SHEET NO 3 OF 16

CALCULATED BY 9/12 DATE 8/19/81

CHECKED BY F. A. C. DATE 8/24/81

SCALE None

Dead (Cont'd From Sheet 1)

Load Volume x Unit Wt. = W x arm about toe = M

Total Concrete in Buttrass,

Floor, U/S Face & Top = 519.43 K

24,341.58 Ftk

Check Timber d/s face @ 50#/CF ±

$W_{23} \quad 0.33 \times 25 \times 10 \times 0.050 \text{ K/CF} = 4.13 \times (17.4/2) + 26 = 143.14$

$W_{24} \quad 0.33 \times 10 \times 10 \times \text{"} = 1.65 \times 8/2 + 18 = 36.30$

$W_{25} \quad 0.33 \times 12 \times 10 \times \text{"} = 1.98 \times 11/2 + 7 = 24.75$

7.76 K (< 270)

204.19 (170)

Grand Total

$W_D = 527.19 K$

$\Sigma M = 24,545.77 Ftk$

Neglect: - outlet pipes & valves  
- walkway opening thru buttrass

Location of center of gravity from toe =  $\bar{x}$

$\bar{x} = \frac{\Sigma M_x}{\Sigma V} = \frac{24,545.77}{527.19} = \text{46.56'}$

F. CTA 15A

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JOB BLACK CREEK RES. DAM

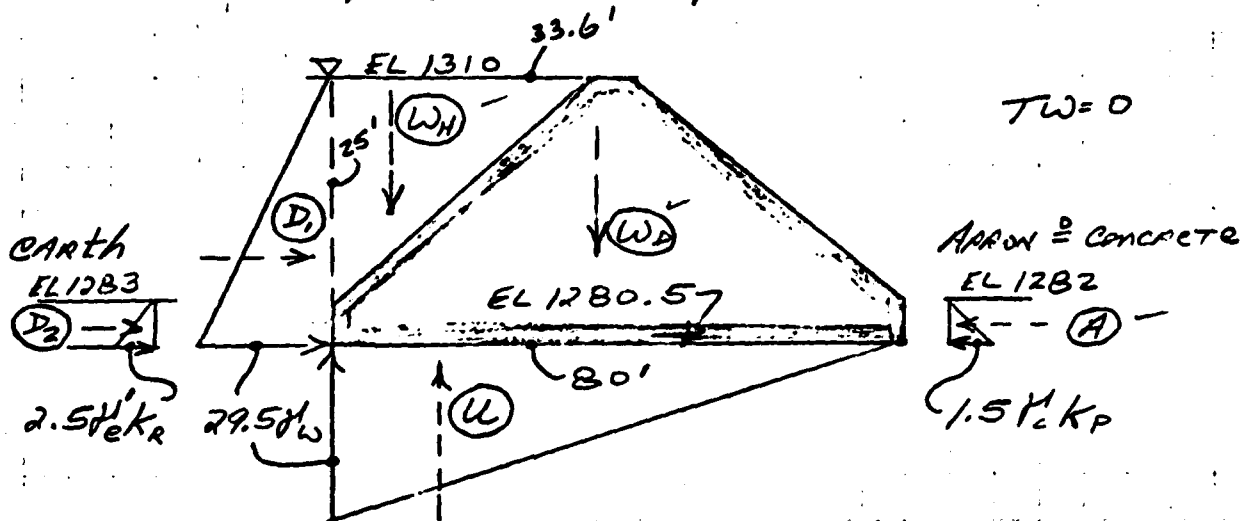
SHEET NO 4 OF 16

CALCULATED BY GMB DATE 8/19/81

CHECKED BY FMC DATE 8/24/81

SCALE None

CASE 1 Normal pool & spillway crest, no TW, full HW  
& TW uplift, small earth load on u/s  
side & apron on d/s side.



TW = 0

APRON = CONCRETE

EL 1282

1.5' K<sub>P</sub>

## OVERTURNING

Resisting Forces x Moment arm about toe =  $M_R$

$W_D$  = dead load =  $(527.19 \text{ k})$  per sheet  $\times 3 \rightarrow 24,545.77$

$W_H$  = wt. of HW over bay  
 $= \frac{1}{2} \times 33.6 \times 25 \times 10 \times 0.0624 = 262.08 \times (33.6 \times \frac{2}{3}) + 46.4 = 18,031.10$

$A$  = apron pressure, where  $K_P$  = coeff. of horiz.

passive earth press = 4.0 assuming apron

is at least as effective as earth &

$M_c = 0.150 \text{ k/cf}$  for concrete

$= (\frac{1}{2} \times 1.5 \times 0.150 \times 4) 1.5 \times 10 = 6.75 \times 1.5/3 = 3.38$

$\Sigma M_R = 42,580.25$   
 $M_R$

## Driving Forces

$D_1$  = normal HW pressure over bay

$= (\frac{1}{2} \times 29.5 \times 0.0624) 29.5 \times 10 = 271.52 \times 29.5/3 = 2669.93$

$D_2$  = submerged earth pressure, where  $M_c' = 140 \text{ #/cf}$

$= 62.4 = 77.6$ , say  $78 \text{ #/cf} = 0.078 \text{ k/cf}$

&  $K_R$  = coeff. of horiz. earth pressure at

rest = 0.5

$= (\frac{1}{2} \times 2.5 \times 0.078 \times 0.5) 2.5 \times 10 = 1.22 \times 2.5/3 = 1.02$

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JOB. BLACK CREEK RES DAM

SHEET NO 5 OF 16

CALCULATED BY JMA DATE 3/17/31

CHECKED BY F.B.K. DATE 8/27/81

SCALE None

CASE 1 OVERTURNING (Cont'd)

$U$  = normal HW uplift

$$= \left( \frac{1}{2} \times 27.5 \times 0.0624 \right) 80 \times 10 = 736.32 \times 80 \times \frac{2}{3} = 39,270.40$$

$$\Sigma M_D = 41,941.35$$

$$FS = \frac{\Sigma M_R}{\Sigma M_D} = \frac{42,580.25}{41,941.35} = 1.02$$

$$\text{Resultant from toe} = d = \frac{\Sigma M_x}{\Sigma V} = \frac{\Sigma M_R - \Sigma M_D}{W_D + W_H - U}$$

$$d = \frac{638.9}{527.19 + 262.08 - 736.32} = \frac{638.9}{52.95} = 12.07 \times \frac{6}{80} = 0.156$$

CASE 1 SLIDING Assume failure plane along concrete/soil contact. Neglect u/s & d/s cutoffs because not certain that they are reinforced or that they even exist. Same diagram as Case 1 O/T, sheet 4. ✓

Resisting Forces

$$R_s = \text{Horiz. resisting force} = \Sigma V \tan \phi + c \quad (\text{Reference 1})$$

where  $C$  = cohesion along failure plane = 0

$\phi$  = angle of sliding friction = 30 Assumed along concrete/soil contact

$\Sigma V$  = Vertical effective force

$$= 52.95 \text{ k per above}$$

$$R_s = 52.95 \tan 30^\circ = 30.57 \text{ k}$$

Driving Forces

$$D_1 = \text{Normal HW pressure} = \text{per sheet 4} = 271.52$$

$$D_2 = \text{submerged earth pressure} = " " " = 1.22$$

$$A = \text{Apron pressure} = " " " = 6.75$$

$$D_s = \text{horiz. driving force} = 265.99 \text{ k}$$

$$FS = R_s / D_s = 30.57 / 265.99 = 0.11$$

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JOB BLACK CREEK RES. DAM

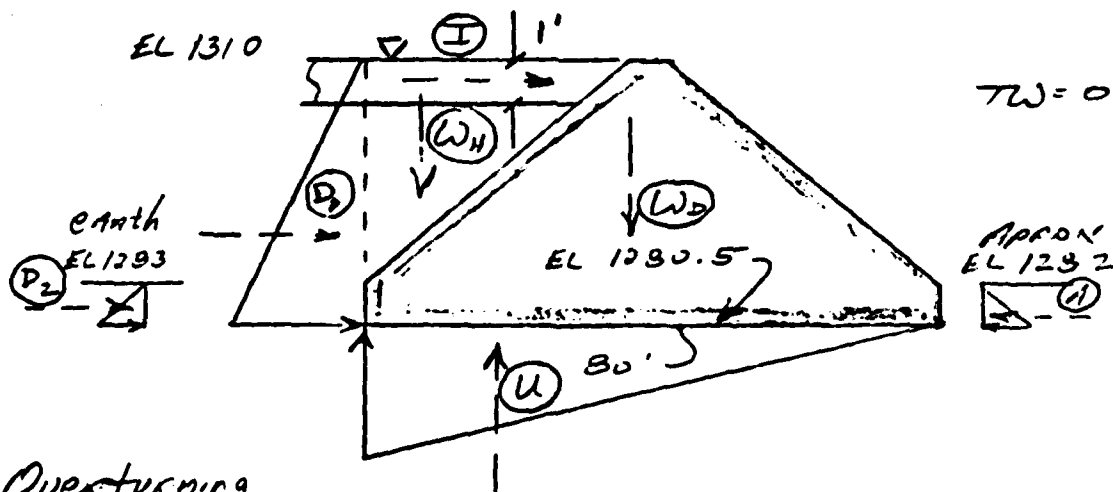
SHEET NO 6 OF 16

CALCULATED BY JMR DATE 3/13/81

CHECKED BY EJC DATE 3/24/81

SCALE None

CASE 2 - Normal pool plus ice load of 5k/LF for ice 1' thick.



Overturning

Resisting Forces x Moment arm about toe =  $M_R$   
All same as Case 1, sheet 4  $\rightarrow \Sigma M_R = 42,580.25$

Driving Forces

$D_1, D_2, \& U$  same as Case 1, sheet 4  $\rightarrow = 41,941.35$   
 $I = \text{Ice load} = 5k/LF \times 10 = 50k \times (29.5 - 0.5) = 1450.00$   
over bay  $\Sigma M_D = 43,391.35$   
 $FS = \Sigma M_R / \Sigma M_D = \frac{42,580.25}{43,391.35} = 0.98$

Resultant from toe =  $d = \Sigma M_T / \Sigma V = \frac{\Sigma M_R - \Sigma M_D}{\Sigma V \text{ same as Case 1}}$

$d = \frac{-811.10}{52.95} = -15.32 \times 5/80 = -0.196$

CASE 2 - SLIDING same failure plane & theory as Case 1, sheet 5

Resisting Forces since  $\Sigma V$  same as Case 1,  $R_s = 30.57k$  per Case 1

Driving Forces

$D_1, D_2, \& A$  same as Case 1, sheet 5  $\rightarrow 265.99k$   
 $I = \text{ice load} = \rightarrow 50.00k$   
 $D_s = 315.99k$

$FS = R_s / D_s = 30.57 / 315.99 = 0.10$

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JOB: BLACK CREEK RES. DAM

SHEET NO. 7 OF 16

CALCULATED BY: GAG DATE: 8/12/81

CHECKED BY: F.P.C. DATE: 8/24/81

SCALE: None

## ESTIMATE TAILWATER FOR FLOOD CONDITIONS

$Q = 10,000$  cfs for  $1/2$  PMF @ EL 1313.2 per Table 5.1

$Q = 21,300$  cfs for PMF @ EL 1321.3 " " "

Assume uniform flow in d/s channel where:

$$Q = 1.486 AR^{2/3} S^{1/2} \text{ (Manning's Eq., Ref B)}$$

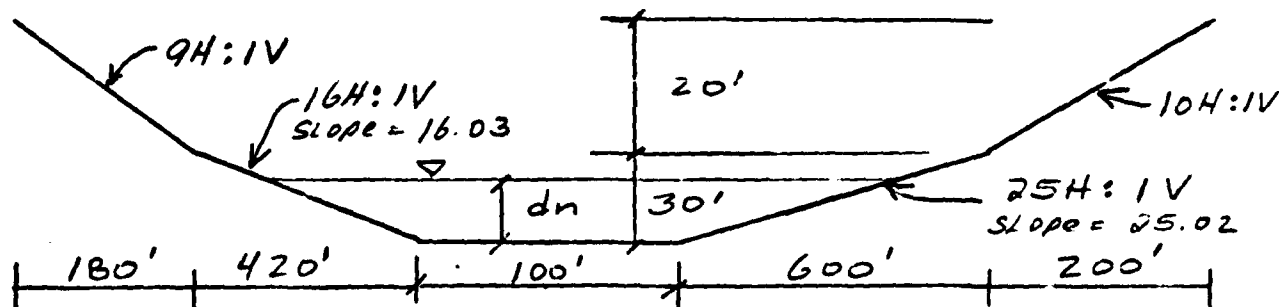
where  $A$  = cross sectional area of flow, ft<sup>2</sup>

$R$  = hydraulic radius =  $A / \text{wetted perimeter (P)}$

$n$  = roughness coeff. = 0.04 for natural channel

$S$  = slope of energy gradient, Assume equal to avg. slope of channel =  $20/4100' = 0.005$  per USGS sheet, like Appendix C-5.

Approx. Channel Section 1600' d/s of dam



$$Q = \frac{1.486}{0.04} (0.005)^{1/2} AR^{2/3} = 2.63 AR^{2/3}$$

$d_n$	Top Width	$A$	$P$	$R^{2/3} = (A/P)^{2/3}$	$Q = 2.63 AR^{2/3}$
8	428	2112	428.4	2.91	16,175 cfs
7	387	1704.5	387.35	2.70	12,097 $1/2$ PMF
6	346	1338	346.3	2.47	8,704

8	Same as above				16,175
9	469	2560.5	469.45	3.12	20,984 PMF
10	510	3050	510.5	3.31	26,569

By interpolation, for  $1/2$  PMF  $Q = 10,000$  cfs,  $d_n = 6.4'$

& for PMF  $Q = 21,300$  cfs,  $d_n = 9.1$

SAY 9'

SAY 6'

Round down to be conservative for stability



AD-A109 970

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SEP 81 K J MALE

F/G 13/13

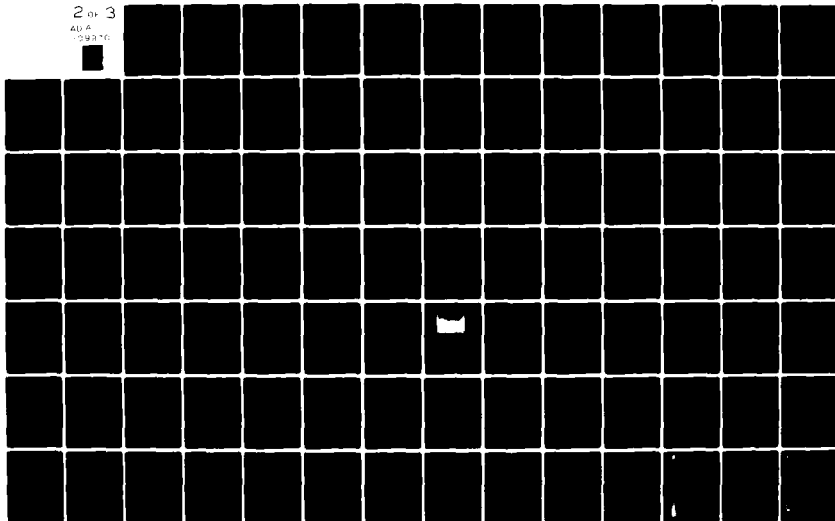
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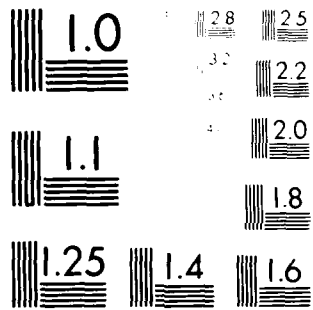
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2 of 3

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MICROCOPY RESOLUTION TEST CHART  
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JOB BLACK CREEK RES DAMSHEET NO. 9OF 16CALCULATED BY YABDATE 8/19/81CHECKED BY FRKDATE 8/24/81SCALE NoneCASE 3 - 1/2 PMF OVERTURNING (Cont'd)

$$W_{w1} = \text{Wt. of water inside bay (deduct buttress volume)}$$

$$= [6' \times 55' \times (10 - 2)] 0.0624 = 164.74 \times (55/2 + 19) = 7660.22$$

$$W_{w2} = (1' \times 5' \times 8') 0.0624 = 2.50 \times (1/2 + 55 + 19) = 185.95$$

$$W_{w3} = (1/2 \times 19 \times 6 \times 8) 0.0624 = 28.45 \times (19 \times 2/3) = 360.42$$

$$\Sigma M_R = 61,694.94$$

Driving Forces x Moment arm about toe = M<sub>D</sub>

$$D_2 = \text{Normal HW pressure} = \text{same as } D_1, \text{ Case 1 sheet 4} = 2669.93$$

$$D_3 = \text{Submerged earth pressure} = " " D_2, " " = 1.02$$

$$U_1 = \text{Normal HW uplift} = " " U_1, " " 5 = 39,270.40$$

$$U_2 = \text{Portion of flood TW uplift} = 7.9 \times 0.0624 \times 33.6 \times 10$$

$$= 165.63 \times (33.6/2 + 46.4) = 10,468.10$$

$$U_3 = " " " " " = 1/2 \times 0.3 \times 0.0624 \times 33.6 \times 10$$

$$= 3.14 \times [(33.6 \times 2/3) + 46.4] = 216.37$$

$$D_1 = \text{Flood HW pressure}$$

$$= 8.2 \times 0.0624 \times 29.5 \times 10 = 150.95 \times 29.5/2 = 2226.45$$

$$\Sigma M_D = 54,852.27$$

$$FS = \Sigma M_R / \Sigma M_D = \frac{61,694.94}{54,852.27} = 1.12$$

$$\text{Resultant from toe} = d = \frac{\Sigma M_T}{\Sigma V} = \frac{\Sigma M_R - \Sigma M_D}{W_D + \Sigma W_H + \Sigma W_w - \Sigma U}$$

$$d = \frac{6842.67}{527.19 + 434.00 + 195.69 - 905.09} = \frac{6842.67}{251.79} = 27.18$$

$$d = 27.18 \times \frac{b}{30} = 0.34 b$$

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JOB BLACK CREEK RES. DAM

SHEET NO. 10 OF 16

CALCULATED BY QMB DATE 8/19/81

CHECKED BY F.A.S. DATE 8/24/81

SCALE NONE

CASE 3 - 1/2 PMF SLIDING same failure plane & theory  
AS Case 1, sheet 5.

Resisting Forces  $\Sigma V = 251.79 \text{ k}$  from above

$$\therefore R_s = 251.79 \tan 30^\circ = 145.37 \text{ k}$$

Driving Forces

$D_1 = \text{normal HW pressure} = \text{same as } D_1, \text{ Case 1, sheet 5} = 271.52$

$D_2 = \text{submerged earth pressure} = " " D_2, " " = 1.22$

$D_3 = \text{flood HW pressure} = \text{same as sheet 9} = 150.95$

$A = \text{submerged apron pressure} = " " B = 3.94$

$TW = \text{flood TW pressure} = " " B = 17.55$

$$D_s = 402.20 \text{ k}$$

$$FS = R_s / D_s = 145.37 / 402.20 = 0.36$$

CASE 4 - PMF OVERTURNING same methodology & dwg.  
AS Case 3, sheet 8, w/  $d_n = 9'$

Resisting Forces

$W_D, W_H, \& A$  same as Case 3, sheet 8 = 42,578.34

$W_{H2} = \text{wt. of flood HW over bay when W.S.}$

$\text{EEL } 1321.3 \text{ OR } 11.3' \text{ over spillway}$

$$= 11.3 \times 33.6 \times 10 \times 0.0624 = 236.92 \times \left( \frac{33.6}{2} + 46.4 \right) = 14,973.36$$

$TW = \text{flood TW pressure over bay}$

$$= \left( \frac{1}{2} \times 10.5 \times 0.0624 \right) 10.5 \times 10 = 34.40 \times 10.5/3 = 120.39$$

$W_{W1} = \text{wt. of water inside bay a } 9' \text{ deep, on } 2.5' \text{ over change in buttress thickness}$

$$= [6.5 \times 45 \times (10 - 2)] = 2340$$

$$[2.5 \times 45 \times (10 - 1.67)] = 937.1$$

$$3277.1 \times 0.0624 = 204.49 \text{ k}$$

$$\times (45/2 + 25) = 9,713.32$$

$$W_{W2} = 6 \times 6.5 \times 8 = 312$$

$$6 \times 0.5 \times 8.33 = 24.99$$

$$336.99 \times 0.0624 = 21.03 \text{ k}$$

$$\times (6/2 + 45 + 25) = 1,535.19$$

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JOB BLACK CREEK RES DAM

SHEET NO. 11 OF 16

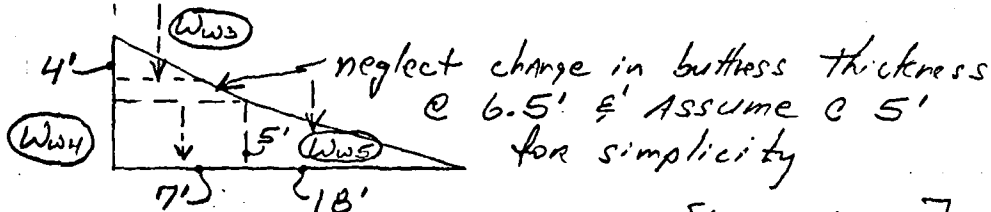
CALCULATED BY JMB DATE 8/19/31

CHECKED BY FNC R 8/24/31

SCALE None DATE 8/24/31

# CASE 4 - PMF OVERTURNING (Cont'd)

$W_{W3} =$



$$W_{W3} = \frac{1}{2} \times 4 \times 7 \times 8.33 \times 0.0624 = 7.28 \text{ k} \times \left[ \left( 7 \times \frac{2}{3} \right) + 18 \right] = 164.95$$

$$W_{W4} = 5 \times 7 \times 8 \times 0.0624 = 17.47 \times (7/2 + 18) = 375.65$$

$$W_{W5} = \frac{1}{2} \times 5 \times 18 \times 8 \times 0.0624 = 20.46 \times (18 \times \frac{2}{3}) = 269.57$$

$$\Sigma M_R = 69,731.27$$

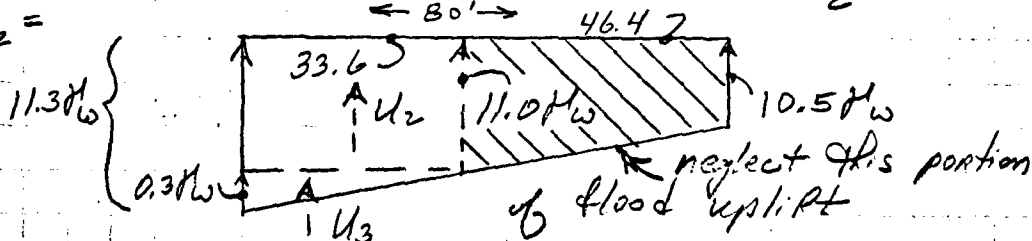
## Driving Forces

$P_2, P_3 \& U_1$  same as Case 3, sheet 9 = MD 41,941.35

$D_1 =$  flood HW pressure

$$= 11.3 \times 0.0624 \times 29.5 \times 10 = 208.01 \times \frac{29.5}{2} = 3068.15$$

$U_2 =$



$$U_2 = 11 \times 0.0624 \times 33.6 \times 10 = 230.63 \times \left( \frac{33.6}{2} + 46.4 \right) = 14,575.84$$

$$U_3 = \left( \frac{1}{2} \times 0.3 \times 0.0624 \times 33.6 \right) 10 = 3.14 \times \left[ \left( 33.6 \times \frac{2}{3} \right) + 46.4 \right] = 216.37$$

$$\Sigma M_D = 59,801.71$$

$$FS = \Sigma M_R / \Sigma M_D = \frac{69,731.27}{59,801.71} = 1.17$$

Resultant from toe =  $d = \Sigma M_T / \Sigma V = \frac{\Sigma M_R - \Sigma M_D}{W_D + \Sigma W_H + \Sigma W_W - \Sigma U}$

$$d = \frac{9929.56}{527.19 + 499.00 + 272.73 - 970.09} = \frac{9929.56}{328.83}$$

$$d = 30.20 \times \frac{b}{80} = 0.38$$

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JOB BLACK CREEK RES. DAM

SHEET NO. 12

OF 16

CALCULATED BY F.M.C.

DATE 8/19/81

CHECKED BY F.M.C.

DATE 8/24/81

SCALE None

CASE 4 - PMF SLIDING same methodology as Case 3, sheet 10

Resisting Forces  $\Sigma V = 328.83 \text{ K}$  from o/t above

$$\therefore R_s = 328.83 \tan 30^\circ = 189.85 \text{ K}$$

Driving Forces

$D_2 \text{ \& } D_3$  same as Case 3, sheet 10 = 272.74

$D_1 =$  flood HW pressure = same as sheet 11 = 208.01

$A =$  submerged apron pressure = " " " 10 =  $\ominus$  3.94

$TW =$  flood TW pressure = " " " 10 =  $\ominus$  34.40

$D_s$  442.41

$$FS = R_s / D_s = 189.85 / 442.41 = \textcircled{0.43}$$

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JOB BLACK CREEK RES. DAM

SHEET NO. 13 OF 16

CALCULATED BY FM DATE 8/19/81

CHECKED BY FM DATE 8/24/81

SCALE None

CASE 5 - Normal Pool plus seismic load in Seismic Zone 2 - coeff. per Reference 1

$$\alpha_{\text{horiz}} = 0.05 = A_{H/2}$$

$$\alpha_{\text{vert.}} = 1/2 \text{ horiz.} = 0.025 = A_{V/2}$$

$\bar{X}$  from toe to center of gravity = 46.56' per sheet 3

Find  $\bar{y}$  from toe (refer to dwg. on sheet 2)

Dead Load		W from sheet 1 & 3	x	about toe	=	M <sub>y</sub>
W <sub>1</sub>	10.77 k		x	(10/2 + 17.5)	=	242.33
W <sub>2</sub>	12.85		x	[(9.5/2) + 8]	=	163.84
W <sub>3</sub>	10.53		x	(6.5/2 + 1.5)	=	50.02
W <sub>4</sub>	13.41		x	(10/3 + 17.5)	=	279.37
W <sub>5</sub>	31.98		x	(9.5/2 + 8)	=	407.75
W <sub>6</sub>	15.19		x	(9.5/3 + 8)	=	169.62
W <sub>7</sub>	51.11		x	(6.5/2 + 1.5)	=	242.77
W <sub>8</sub>	3.94		x	(5.5/2 + 1.5)	=	16.75
W <sub>9</sub>	3.19		x	(4/2 + 19.5)	=	68.59
W <sub>10</sub>	3.19		x	(2/2 + 17.5)	=	59.02
W <sub>11</sub>	19.04		x	(9.5/2 + 8)	=	242.76
W <sub>12</sub>	7.52		x	(7.5/2 + 8)	=	88.36
W <sub>13</sub>	3.51		x	(3.5/2 + 8)	=	34.22
W <sub>14</sub>	2.00		x	(2/2 + 8)	=	18.00
W <sub>15</sub>	39.00		x	(6.5/2 + 1.5)	=	185.25
W <sub>16</sub>	4.80		x	(4/2 + 1.5)	=	16.80
W <sub>17</sub>	6.75		x	(2.5/3 + 3)	=	25.87
W <sub>18</sub>	8.10		x	(1.5/2 + 1.5)	=	18.23
W <sub>19</sub>	180.00		x	1.5/2	=	135.00
W <sub>20</sub>	27.00		x	(4.5/2 + 1.5)	=	101.25
W <sub>21</sub>	53.55		x	(22.5/2 + 6)	=	923.74
W <sub>22</sub>	12.00		x	(2/2 + 27.5)	=	342.00
W <sub>23</sub>	4.13		x	(18/2 + 11.5) ±	=	84.67
W <sub>24</sub>	1.65		x	(5/2 + 6.5) ±	=	14.85
W <sub>25</sub>	1.98		x	(2.5/2 + 4) ±	=	10.40

$$W_D = 527.19 k = \Sigma H$$

$$\bar{y} = \Sigma M_y / \Sigma H = \underline{7.48'}$$

$$\Sigma M_y = 3941.46$$

C. T. MALE ASSOCIATES, P. C.

ENGINEERS

SURVEYORS

ARCHITECTS

LANDSCAPE ARCHITECTS

PLANNERS

3000 TROY ROAD, SCHENECTADY, N. Y. 12309

(518) 785-0976

JOB BLACK CREEK RES DAM

SHEET NO 14

OF 16

CALCULATED BY GPA

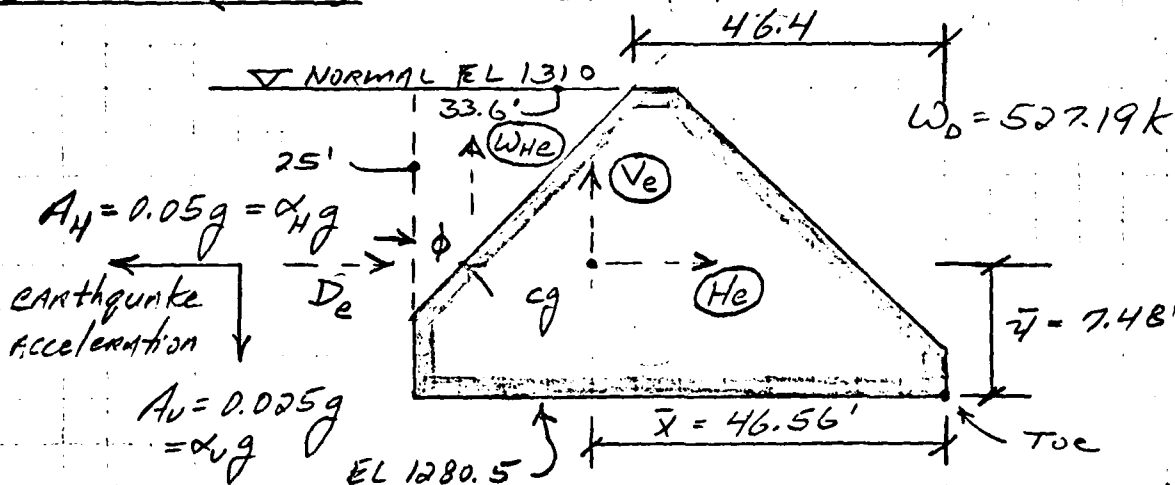
DATE 8/20/81

CHECKED BY FAC

DATE 8/24/81

SCALE None

CASE 5 (cont'd)



Earthquake acceleration upstream & down cause inertia forces to be directed the opposite way, i.e., downstream & up, which is the most critical case for reservoir full.

$H_e$  = horiz. inertia force due to acceleration of dam  
like  $F = Ma$  or  $W_D = Mg$  &  $M = W_D/g$

$$= MA_H = W_D/g \alpha_H g = W_D \alpha_H = 527.19(0.05) = 26.36k$$

$V_e$  = vert. inertia force due to acceleration of dam  
 $= W_D \alpha_V = 527.19(0.025) = 13.18k$

$W_{He}$  = vert. inertia force of reservoir HW

$$= W_H \alpha_V = 262.08 \text{ (Case 1, sheet 4)} 0.025 = 6.55k$$

$D_e$  = Additional horiz. reaction of reservoir water on dam

$$= 0.726 P_e y \quad (\text{Design of Small Dams, Ref. 8})$$

where  $y$  = depth to toe or failure plane = 29.5'

$$P_e = C \alpha_H H_w h$$

where  $\alpha_H = 0.05$

$$H_w = 0.0624 k/cf$$

$$h = \text{total depth at section} = y = 29.5'$$

C. T. MALE ASSOCIATES, P. C.

ENGINEERS

SURVEYORS

ARCHITECTS

LANDSCAPE ARCHITECTS

PLANNERS

3000 TROY ROAD, SCHENECTADY, N. Y. 12309

(518) 785-0976

JOB BLACK CREEK RES. DIRM

SHEET NO

15

OF

16

CALCULATED BY

JMR

DATE

8/20/81

CHECKED BY

KRC

DATE

8/24/81

SCALE

None

CASE 5 Cont'd

$$\phi = \text{Angle of u/s face from vertical} \\ = \text{ARC tan } 33.6/25 = 53^\circ$$

$$C = 0.35 \text{ for } \phi = 53^\circ \text{ \& } y/h = 1.0 \\ \text{per Fig. 222, Ref. B}$$

$$\text{so } P_e = (0.35 \times 0.05 \times 0.0624 \times 29.5) = 0.0322 \text{ k/sf}$$

$$P_e = 0.726 \times 0.0322 \text{ k/sf} \times 29.5 \text{ ft.} \times (10' \text{ bay}) = \underline{6.90 \text{ K}}$$

Overturning

$$\text{Resisting Forces} \times \text{Moment Arm about toe} = M \\ \text{Same as Case 1, sheet 4} \rightarrow = 42,580.25$$

$W_{He}$  = reduction due to inertia force of reservoir HW

$$= -6.55 \text{ K as before} \times [(33.6 \times 2/3) + 46.4] = -450.64 \\ \Sigma M_R = \underline{42,129.61}$$

Driving Forces

Same as Case 1, sheet 5  $\rightarrow$  = 41,941.35

$$V_e = \text{vertical inertia force due to acc. of dam} \\ = 13.18 \text{ K as before} \times 46.56 = 613.66$$

$$H_e = \text{horiz. inertia force due to acc. of dam} \\ = 26.36 \text{ K as before} \times 7.48 = 197.17$$

$$D_e = \text{Additional horiz. reaction of water} \\ = 0.299 P_e y^2 \text{ (Ref. B)} \\ = 0.299 \times 0.0322 \frac{\text{K}}{\text{ft}^2} \times 29.5^2 \frac{\text{ft}^2}{\text{ft}} \times \frac{\text{ft}}{\text{ft}} \times (10 \text{ ft bay})$$

$$= 83.79 \text{ Kft} \\ \Sigma M_D = \underline{42,835.97}$$

$$FS = \Sigma M_R / \Sigma M_D = 42,129.61 / 42,835.97 = \underline{0.98}$$

$$\text{Resultant from toe} = d = \Sigma M_T / \Sigma V = \frac{\Sigma M_R - \Sigma M_D}{\Sigma V_{\text{Case 1}} - W_{He} - V_e}$$

$$d = \frac{-706.36}{52.95 - 6.55 - 13.18} = \frac{-706.36}{33.22} = -21.26 \times 6/80 = \underline{-0.276}$$

C. T. MALE ASSOCIATES, P. C.

ENGINEERS

SURVEYORS

ARCHITECTS

LANDSCAPE ARCHITECTS

PLANNERS

3000 TROY ROAD, SCHENECTADY, N. Y. 12309

(518) 783-0976

JOB

BLACK CREEK RES. DAM

SHEET NO

16

OF

16

CALCULATED BY

JMR

DATE

8/20/81

CHECKED BY

F.D.C.

DATE

8/24/81

SCALE

None

CASE 5 - SEISMIC SLIDING same theory as Case 1, sheet 5  
Resisting Forces

$\Sigma V = 33.22 \text{ k}$  from o/t above

$R_s = 33.22 \tan 30^\circ = \underline{19.18 \text{ k}}$

Driving Forces

Same as Case 1, sheet 5  $\rightarrow$   $= 265.99$

$H_e =$  horiz. inertia force due to acc. of dam

$=$  per sheet 14

$= 26.36$

$D_e =$  Add. to horiz. reaction of water

$=$  per sheet 15

$= 6.90$

$D_s = 299.25$

$FS = R_s/D_s = 19.18/299.25 = \underline{0.06}$

IF U/S & D/S CUTOFF WALLS ASSUMED EFFECTIVE IN RESISTING SLIDING

Assume plane through top of walls at bottom of foundation

Additional resistance  $= R_s = V_c A$

where  $A =$  shear area of concrete

$= (6' + 4') \times 10' \text{ bay} = 100 \text{ ft}^2$

$V_c =$  conc. shear strength  $= 2.0 \sqrt{f'_c}$  (ACI Code)

Assume  $f'_c = 3000 \text{ psi}$ , then  $V_c = 110 \text{ psi}$ .

OR 75 psi Allowable per specs. on

Appendix F3-2

Use  $V_c = 75 \text{ psi} \times 144 \frac{\text{in}^2}{\text{ft}^2} = 10.8 \text{ k/sf}$

so  $R_s = 10.8 \times 100 = 1,080 \text{ k}$

For Case 1, sheet 5,  $R_{s \text{ TOTAL}} = 30.57 + 1080 = 1110.57 \text{ k}$

$FS = R_s/D_s = 1110.57/265.99 = \underline{4.18}$  but overturning still a problem & don't know if cutoff's exist.

APPENDIX E  
REFERENCES

## BLACK CREEK RESERVOIR DAM, NY 00182

## PHASE I INSPECTION REPORT

REFERENCES

This is a general list of references pertinent to dam safety investigations. Not all references listed have necessarily been used in this specific report.

1. "Engineering and Design, National Program For Inspection of Non-Federal Dams", ER 1110-2-106, Dept. of the Army, Office of the Chief of Engineers, 26 September 1979, with Change 1 of 24 March 1980. Included as Appendix D of the ER is "Recommended Guidelines For Safety Inspection of Dams".
2. "HEC-1 Flood Hydrograph Package, Users Manual", The Hydrologic Engineering Center, U.S. Army Corps of Engineers, January 1973.
3. "Flood Hydrograph Package (HEC-1), Users Manual for Dam Safety Investigations", The Hydrologic Engineering Center, U.S. Army Corps of Engineers, September 1978.
4. HMR 33, "Seasonal Variations of Probable Maximum Precipitation, East of the 105th Meridian for Areas 10 to 1000 Square Miles and Durations from 6 to 48 Hours," U.S. Dept. of Commerce, NOAA, National Weather Service, 1956.
5. HMR 51, "All-Season Probable Maximum Precipitation, U.S. East of 105th Meridian for Areas from 1000 to 20,000 Square Miles and Durations from 6 to 72 Hours", U.S. Dept. of Commerce, NOAA, National Weather Service, 1974.
6. HYDRO-35, "Five-to-60 Minute Precipitation Frequency for the Eastern and Central United States", U.S. Dept. of Commerce, NOAA, National Weather Service, June 1977.
7. "Technical Paper No. 40, Rainfall Frequency Atlas of the United States", U.S. Dept. of Commerce, Weather Bureau, 1961.
8. Design of Small Dams, United States Dept. of the Interior, Bureau of Reclamation, Second Edition, 1973, Revised Reprint, 1977.
9. King, Horace W. and Brater, Ernest F., Handbook of Hydraulics, fifth edition, McGraw-Hill Book Co., Inc., New York, N. Y., 1963.
10. "Flood Hydrograph Analyses and Computations", EM 1110-2-1405, U.S. Army Corps of Engineers, 31 August 1959.

11. "Technical Release No. 55, Urban Hydrology for Small Watersheds", U.S. Dept. of Agriculture, Soil Conservation Service (Engineering Division), January 1975.
12. National Engineering Handbook, Section 4, Hydrology, U. S. Dept. of Agriculture, Soil Conservation Service, August 1972.
13. "Hydraulic Design of Spillways", EM 1110-2-1603, U.S. Army Corps of Engineers, 31 March 1965, with Change 1 included.
14. "Standard Project Flood Determinations", EM 1110-2-1411, U.S. Army Corps of Engineers, 26 March 1952.
15. "Hydrologic and Hydraulic Assessment", Appendix D of EC 1110-2-188, U.S. Army Corps of Engineers, 30 December 1977.
16. "Reviews of Spillway Adequacy, National Program of Inspection of Non-Federal Dams", ETL 1110-2-234, U.S. Army Corps of Engineers, 10 May 1978.
17. Hammer, Mark J., Water and Waste-Water Technology, John Wiley & Sons, Inc., New York, 1975.
18. "Hydraulic Charts For the Selection of Highway Culverts", Hydraulic Engineering Circular No. 5, U.S. Department of Commerce, Bureau of Public Roads, December 1965.
19. "Guide for Making a Condition Survey of Concrete in Service", American Concrete Institute (ACI) Journal, Proceedings Vol. 65, No. 11, November 1968, pages 905-918.
20. "Upper Hudson & Mohawk River Basins, Hydrologic Flood Routing Models", New York District, Corps of Engineers, October 1976.
21. "Climatological Data, Annual Summary, New York, 1979", Volume 91, No. 13, National Oceanic and Atmospheric Administration, Asheville, North Carolina.
22. "Climatological Data, New York, September 1980", Volume 92, No. 9, National Oceanic and Atmospheric Administration, Asheville, North Carolina.
23. "Water Resources Data For New York, Water Year 1979", Volume 1, USGS Water-Data Report NY-79-1, U.S. Geological Survey, Albany, New York, 1980.
24. "Maximum Known Stages and Discharges of New York Streams Through 1973", Bulletin 72, U.S. Geological Survey, 1976.
25. "Characteristics of New York Lakes (Gazetteer)", Bulletin 68, U.S. Geological Survey and NYS Department of Environmental Conservation, 1970.

26. "Gravity Dam Design", EM 1110-2-2200, U.S. Army Corps of Engineers, 25 September 1958, with Changes 1 & 2 included.
27. "Gravity Dam Design - Stability", ETL 1110-2-184, U.S. Army Corps of Engineers, 25 February 1974.
28. Terzaghi, Karl and Peck, Ralph B., Soil Mechanics in Engineering Practice, second edition, John Wiley & Sons, Inc., New York, N.Y., 1967.
29. "Geologic Map of New York", Hudson-Mohawk Sheet, New York State Museum and Science Service, University of the State of N.Y., State Education Dept., Albany, N.Y., reprinted 1973.
30. "Landforms and Bedrock Geology of New York State", New York State Museum and Science Service, University of the State of N.Y., State Education Dept., Albany, N.Y., reprinted 1973.

APPENDIX F  
AVAILABLE ENGINEERING DATA AND RECORDS  
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Checklist for General Engineering Data and Interview with Dam Owner	F2
Copies of Engineering Data and Records	F3

## APPENDIX F

## SECTION F1

LOCATION OF AVAILABLE ENGINEERING DATA AND RECORDS

1. Owner: City of Utica Board of Water Supply  
P.O. Box 345  
1 Kennedy Plaza  
Utica, N.Y. 13502  
  
Attn: Russell S. LoGalbo, P.E., Principal Engineer  
(315) 798-3316  
  
Available - Drawings, construction contract and specifications, construction reports, reports, photos, reservoir capacities, reservoir discharges, pamphlet describing history of Utica water supply system.
2. Designer: Ambursen Hydraulic Construction Company  
176 Federal Street  
Boston, Mass.  
(no longer in business).
3. Construction Contractor: Same as designer.
4. Agency: NYS Department of Environmental Conservation  
50 Wolf Road  
Albany, NY 12233  
Attn: George Koch, P.E., Chief, Dam Safety Section  
(518) 457-5557  
  
Available: Inspection reports, photos, letters.

## PHASE I INSPECTION

CHECKLIST FOR GENERAL ENGINEERING DATA  
& INTERVIEW WITH DAM OWNER

Name of Dam BLACK CREEK RESERVOIR DAM Fed. Id.# NY 00182  
 Date 1/29/81 + 6/3/81 Interviewer(s) ED VOPELAK, TOM BENNEDUM  
 Dam Owner/Representative(s) Interviewed, Title & Phone# \_\_\_\_\_  
RUSSEL S. LOGALBO, P.E., PRINCIPAL ENGINEER, CITY OF UTICA  
BOARD OF WATER SUPPLY, PO BOX 345, KENNEDY PLAZA, UTICA, NY, 13502  
(315) 798-3316

1. OWNERSHIP (name, title, address & phone #) \_\_\_\_\_  
CITY OF UTICA BOARD OF WATER SUPPLY  
CHAIRMAN - GAETANO A. CRISTALLI (315) 798 - 3301  
(SAME ADDRESS AS ABOVE)  
PRINCIPAL ENGINEER - RUSSELL S. LOGALBO, P.E. (SEE 1. ABOVE)  
 2. OPERATOR (name, title, address & phone # of person responsible  
 for day-to-day operation) \_\_\_\_\_

CARETAKER - WILLIAM FARBER, GRAY NY  
(315) 845 - 8299

- a. ~~CARETAKER~~  
~~Operator~~ Full/Part time PART TIME

3. PURPOSE OF DAM

- a. Past FLOOD CONTROL / WATER SUPPLY  
 b. Present FLOOD CONTROL FOR SPRING RUNOFF AND  
STORAGE FOR COMPENSATION WATER USED  
TO REPLACE HINCKLEY RESERVOIR WATER USED BY  
CITY OF UTICA WATER SUPPLY SYSTEM

4. DESIGN DATA

- a. Designed When 1906  
 b. By (name, address, phone #, business status) \_\_\_\_\_  
AMBURSEN HYDRAULIC CONSTRUCTION CO.  
176 FEDERAL ST., BOSTON, MASS.  
(FOR CONSOLIDATED WATER CO. OF UTICA)  
 c. Geology Reports NONE KNOWN.  
 d. Subsurface Investigations NONE KNOWN.  
 e. Design Reports/Computations (H&H, stability, seepage)  
NONE - ONLY ON 1963 PLANS

- f. Design Drawings (plans, sections, details) SOME (SEE APPENDIX G).
- g. Design Specifications YES SEE APPENDIX F3-1.
- h. Other N/A

5. CONSTRUCTION HISTORY

## a. Initial Construction

- 1) Completed When 1906
- 2) By (name, address, phone #, business status) AMBURSEN HYDRAULIC CONSTRUCTION CO.  
176 FEDERAL STREET, BOSTON, MASS. (NO LONGER IN BUSINESS)
- 3) Borrow Sources/Material Tests NONE KNOWN.
- 4) Construction Reports/Photos YES - SEE APPENDICES F3-19 TO F3-36.
- 5) Diversion Scheme/Construction Sequence NONE KNOWN.
- 6) Construction Problems NONE KNOWN.
- 7) As-Built Drawings (plans, sections, details) NONE KNOWN.
- 8) Data on Electrical & Mechanical Equipment Affecting Safe Operation of Dam NO ELECTRIC EQUIPMENT.  
NO DATA ON VALVES.
- 9) Other SOME ENGINEER REPORTS DURING CONSTRUCTION,  
+ SOME POST-CONSTRUCTION REPORTS.  
(SEE APPENDIX F3)

- b. Modifications (review design data & initial construction items as applicable & describe) \_\_\_\_\_

NONE , EXCEPT ACCESS HATCH TO SPILLWAY.  
INSTALLED IN D/S FACE OF SPILLWAY SECTION.  
OLD ACCESS SHAFT STILL EXISTS , BUT NOT USED.

- c. Repairs & Maintenance (review design data & initial construction items as applicable & describe) \_\_\_\_\_

• REPLACED SEVERAL OF OUTLET PIPE VALVES.  
 • REPLACED TIMBER DECK ON SPILLWAY - 1974± , 1960± ,  
+ SOMETIME PRIOR.  
 • 1974 CONCRETE REPAIR TO D/S ENDS OF BUTTRESSES.  
 • REFERENCE TO GUNITE WORK IN 1967. BUT NO KNOWLEDGE.  
 • THERE IS EVIDENCE OF REPAIR WORK TO SPILLWAY TRAINING WALLS.

6. OPERATION RECORD

- a. Past Inspections (dates, by, authority, results) \_\_\_\_\_  
7/20/75 - NYS CONSERVATION COMMISSION (SEE APPENDIX F3-37), W/ PHOTO.  
1963 ENGR. REPORT FOR OWNER BY AMBURSEN ENGINEERING CORP. ( )  
9/4/71 - NYS-DEC (APPENDIX F3-74), W/ PHOTOS. (APPENDIX F3-45)
- b. Performance Observations (seepage, erosion, settlement, post-construction surveys, instrumentation & monitoring records) NO INSTRUMENTATION  
 • TOPO SURVEY OF RESERVOIR - 1963  
 • CAPACITY STUDY - 1975 (SEE APPENDIX F3-78)  
 • ICE GETS AS THICK AS 1'
- c. Post-Construction Engineering Studies/Reports \_\_\_\_\_  
 • CAPACITY STUDY (SEE 6.b)  
 • 1963 ENGR REPORT BY AMBURSEN ENGINEERING CORP. (APPENDIX F3-45)  
REPORT CONTAINS 1948 REPORT BY AMBURSEN AS WELL.
- d. Routine Rainfall, Reservoir Levels & Discharges \_\_\_\_\_  
 • RECORDS OF WATER LEVELS - DAILY REPORTS, SENT MONTHLY TO  
WATER BOARD, KEPT IN ENGR'S OFFICE FOR PAST 20 YEARS  
SEE APPENDIX F3-83  
 • BELIEVED THAT THERE ONCE WAS RAIN GAGE AT SITE , PERIOD OF OR  
EXISTANCE OF RECORDS UNKNOWN.

- e. Past Floods That Threatened Safety (when, cause, discharge, max. pool elevation, any damage) \_\_\_\_\_

NONE KNOWN - SEE RECORD OF HIGHEST WATER LEVELS,  
(SEE APPENDIX F3-93)

- f. Previous Failures (when, cause, describe) \_\_\_\_\_

NONE KNOWN.

- g. Earthquake History (seismic activity in vicinity of dam) \_\_\_\_\_

NO RECORDS.

7. VALIDITY OF DESIGN, CONSTRUCTION & OPERATION RECORDS (note any apparent inconsistencies) \_\_\_\_\_

• LOG SLUICE IS ONLY 8.6' WIDE BY 6' HIGH.

• SPILLWAY CONFIGURATION IN FIELD DIFFERS SOMEWHAT FROM  
WHAT IS SHOWN ON PLANS.

8. OPERATION & MAINTENANCE PROCEDURES

- a. Operation Procedures in writing? NO Obtain copy or describe. (reservoir regulation plan, normal pool elevation and status of operating facilities, who operates & means of communication to controller, mode of operating facilities, i.e., manual, automatic, remote) \_\_\_\_\_

• NO FLASHBOARDS ON SPILLWAY, STOP LOGS NORMALLY IN PLACE

• NORMAL WINTER LEVEL @ SPILLWAY CREST

• GATES OPERATED PRIOR TO SPRING RUNOFF AS DETERMINED BY  
NYSDOT + NIAGARA MOHAWK POWER CORP. GATES ON OUTLETS ARE  
OPENED FULL TO DRAIN RESERVOIR AS MUCH AS POSSIBLE TO ACCOMMODATE  
SPRING RUNOFF

• ATTEMPT TO CLOSE GATES AS SOON AS WATER LEVEL REACHES SPILLWAY CREST

• GATES ALWAYS OPEN 5 TURNS, IN SUMMER LEVEL WILL DROP 2' TO 3'

• MANUAL OPERATION OF OUTLETS BY WATER DEPT. PERSONNEL, NOT CARETAKER

- b. Maintenance Procedures in writing? NO Obtain copy or describe. \_\_\_\_\_

• CARETAKER VISITS SITE DAILY + LIVES IN WATER BOARD  
OWNED HOUSE NEAR DAM

• SOME TREE CUTTING IN PAST ON EMBANKMENT TO LEFT  
OF OVERFLOW SECTION, NONE ON RIGHT.

- c. Emergency Action Plan & Warning System in Writing? NO  
Obtain copy or describe. (actions to be taken to  
minimize the D/S effects of an emergency) \_\_\_\_\_

• NO REAL THOUGHT GIVEN

• WOULD CALL STATE POLICE

• CARETAKER HAS PUBLIC PHONE ONLY

9. OTHER

## APPENDIX F

## SECTION F3

## COPIES OF ENGINEERING DATA AND RECORDS

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Report on Proposed Reservoir and Dam, by Consolidated Water Company of Utica - April 22, 1906.	F3-13
Progress Report on Dam Construction, by W.S. Bacot, Engr., and A. B. Tracy, Engr. - May 28, 1906.	F3-19
Progress Report on Dam Construction, by W.S. Bacot, Engr., and A. B. Tracy, Engr. - June 12, 1906.	F3-30
Dam Inspection Report, by NYS Conservation Commission (C.W.H. Douglass) - July 20, 1915.	F3-37
Photo of Dam - July 20, 1915.	F3-41
Article on Grays Dam, believed to be from around 1920's or 1930's.	F3-42
Working Papers for Engineering Report, and Report on Field Inspections, etc., by Ambursen Engineering Corporation - 1963.	F3-45
Inspection Report, by NYS-DEC - September 14, 1971.	F3-74
Photos of Dam - July 14, 1971.	F3-77
Gray Reservoir Capacities, by A. I. Lashure, L.S. - 1975.	F3-78
Letter to J. N. Hunter Concerning Dam Inspection of September 14, 1971, by NYS-DEC (by K.D. Harmer) - February 29, 1980.	F3-81
Maximum Recorded Discharges from Utica Board of Water Supply Records - June 5, 1981.	F3-83

CONTRACT  
FOR CONSTRUCTION OF DAM,  
UPPER GRAY RESERVOIR SITE.

CONSOLIDATED WATER COMPANY  
OF UTICA, N. Y.

--with--

AMBURSEN HYDRAULIC CONSTRUCTION CO

Dated, April 19th, 1906

ORIGINAL.

*Gray Reservoir*  
*Eng. H. H. H.*

OWNER

F3-1

GENERAL SPECIFICATIONS  
FOR  
CONCRETE-STEEL GRAVITY DAMS,  
BY THE  
AMBURSEN  
HYDRAULIC CONSTRUCTION COMPANY,  
176 FEDERAL STREET, BOSTON, MASS.

**GENERAL CONDITIONS.**

These specifications are intended to embrace all the labor and materials required in the erection of a Concrete-Steel

Dam with bulkheads across *Black Creek*  
at *Upper Gray N.Y.*

The whole work to be comprised within any contract or contracts to be made for same.

The Contractor shall furnish superintendence and materials as per attached Proposal, and all other labor, material and incidentals shall be provided by the Owner or by the Contractor on the Owner's account, and at strict net cost to the Owner without percentage or other profit to the Contractor. All materials shall be the best of their respective kinds and all workmanship of the best quality.

**1. PLANS.** The work shall be constructed in accordance with drawings made and furnished by the Ambursen Hydraulic Construction Company, and under these specifications, to the full intent and meaning of the same.

The specifications and drawings are intended to describe and provide for the complete work. They are intended to be co-operative, and what is called for by either is as binding as if called for by both.

The work herein described shall be completed in every detail, notwithstanding that every item necessarily involved is not particularly mentioned.

The contract price shall be based upon these specifications and the said drawings, which are hereby made part of the contract.

**2. LOADS.** In estimating loads, concrete shall be assumed at 140 lbs. per cubic foot and water at 62.5 lbs. per cubic foot. Such other loads as may come upon the structure shall be specified by the Owner for whom the structure is built.

**3. CONDITIONS OF CALCULATIONS.**

Modulus of elasticity of concrete ..... 1,500,000

Modulus of elasticity of steel ..... 30,000,000

**MAXIMUM COMPRESSION ALLOWED ON CONCRETE.**

Exclusive of temperature stresses ..... 500 lbs. per sq. inch

Including stress due to 40 degrees variation in temperature ..... 600 lbs per sq. inch

All parts shall be designed to a factor of safety of not less than 5 with concrete six months old.

No tension stress shall be allowed on concrete.

Maximum shear allowed on concrete, 75 lbs. per sq. inch.

OWNER

The sand shall be clean, sharp and coarse, or coarse and fine mixed, free from sewage, mentioned.  
sand, and broken stone or gravel, and mixed with clean water in the proportions hereinafter mentioned.  
7. PORTLAND CEMENT CONCRETE. The concrete shall be composed of cement,

#### MAXIMUM STRESS ALLOWED ON STEEL.

In deck, apron, beams, base, or any other part subjected to transverse stress, the steel shall be assumed to take the entire tensile stress without aid from the concrete, and shall have an area sufficient to develop the full compressive strength of concrete composed of 1 part Portland cement, 3 parts sand, and 6 parts of broken stone, at the age of six months.

The imbedded steel under a stress not exceeding 16,000 lbs. per sq. inch shall be capable of taking the entire load without tensile aid from the concrete.

In buttresses and parts subjected to compression only, no allowance shall be made for the strength of the steel imbedded therein, which will be used only as a precaution against cracks due to shrinkage or changes in temperature.

4. DISCREPANCIES. In the event of any discrepancies between the drawings and the figures written on them, the figures shall be adhered to. In case of any discrepancy between the drawings and the specifications, the specifications shall be adhered to.

5. FOUNDATIONS. All foundations shall be as shown on plans, and conform to the dimensions marked thereon.

Foundations on rock shall be prepared by removing all sand, mud, or other soft materials, and by excavating the bed rock in such manner as may be described or shown on the drawings.

Foundations on hard pan, gravel, gravel and clay, or cemented sand or other materials intended to carry the load without piles, shall be excavated to the depths shown on plans, including excavation for cut-off walls if called for.

6. CEMENT. No cement shall be used except established brands of high grade Portland cement which have been in successful use under similar conditions to the work proposed for at least three years, and which has been seasoned or subjected to aeration for at least thirty days before leaving the factory. All cement shall be dry and free from lumps, and immediately upon receipt shall be stored in a dry, well covered and ventilated place, thoroughly protected from the weather. If required, the Contractor shall furnish a certified statement of the chemical composition of the cement, and of the raw material from which it is manufactured.

The fineness of the cement shall be such that at least 90 per cent will pass through a sieve of No. 40 wire, Stubbs gauge, having 10,000 openings per sq. inch, and at least 75 per cent will pass through a sieve of No. 45 wire, Stubbs gauge, having 40,000 openings per sq. inch.

Samples for testing may be taken from every tenth barrel. The samples will be mixed thoroughly together while dry and the mixture be taken as the sample for test.

Tensile tests will be made on specimens prepared and maintained until tested at a temperature not less than 60 degrees Fahrenheit. Each specimen shall have an area of one square inch at the breaking section, and after being allowed to harden in moist air for 24 hours shall be immersed and maintained under water until tested.

The sand used in preparing test specimens shall be clean, sharp, crushed quartz retained on a sieve of 30 meshes per lineal inch, and passing through a sieve of 20 meshes per lineal inch. In test specimens prepared from a mixture of one part cement and three parts sand, parts by weight, no more than 12 per cent of water by weight shall be used, and said specimen shall, after seven days, develop a tensile strength of not less than 170 lbs. per sq. inch, and not less than 240 lbs. per sq. inch after 28 days. Cement mixed neat with from 20 per cent to 25 per cent of water to form a stiff paste shall after 30 minutes be appreciably indented by the end of a wire one twelfth inch in diameter loaded to weigh one-quarter pound. Cement made into thin pats on glass plates shall not crack, scale nor warp under the following treatment. Three pats will be made and allowed to harden in moist air at from 60 to 70 degrees Fahrenheit; one of these will be placed in fresh water for 28 days, another will be placed in water which will be raised to the boiling point for 12 hours and then allowed to cool, and the third will be kept in air of the prevailing out-door temperature.

MAXIMUM STRESS ALLOWED ON STEEL.

The sand shall be clean, sharp and coarse, or coarse and fine mixed, free from sewage, mud, clay and all foreign matter.

The gravel shall be of assorted sizes, screened or washed entirely free from scale, clay, loam, or foreign matter, and be free from slime or humus. Clean pit material comprised of coarse and fine gravel naturally mixed in approximately the specified proportions may be used if enough cement is added to make a concrete of the ultimate strength required.

Whenever the amount of work to be done is sufficient to justify it, and for all work exceeding 1000 cubic yards, approved mixing machines shall be used. The ingredients shall be placed in the machine in a dry state, and in the volumes specified, and be thoroughly mixed, after which clean water shall be added and the mixing continued until the wet mixture is thorough and the mass uniform. Open bottom boxes or forms of accurate dimensions shall be used to measure materials for batches of concrete whether to be mixed by hand or by power. All concrete shall be of such consistency that when dumped in place it will quake freely like jelly and the whole mass set within 24 hours. As soon as the batch is mixed it shall be deposited in the work without delay.

The grades of concrete to be used are as follows:

For the buttresses, base, beams, bulkheads and walls, one part Portland cement, three parts sand and six parts broken stone or gravel that will pass through a two and one-half inch mesh, if not otherwise marked on the drawings.

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**F3-4**

**9. CARE OF FINISHED WORK.** Particular care shall be taken of finished work as the work progresses, and the same shall be covered with plank or canvas while setting, if necessary to protect it from the weather. If necessary the concrete shall be thoroughly wet down every 24 hours for at least six days after completion.

**10. CONNECTIONS.** In connecting concrete already set with new concrete, the surface shall be cleaned and roughened, and mopped with a mortar composed of one part cement and one part sand to cement the parts together.

Each course shall be left somewhat rough to insure bonding to the next course above; and if it be already set, it shall be thoroughly cleaned and dampened before the next course is placed upon it. The work shall be carried up in sections of convenient lengths and, so far as practicable, complete without intermission.

**11. EXPANSION JOINTS.** Expansion joints shall be made in the deck and apron in the centre of every sixth or eighth buttress.

**12. BUTTRESSES.** In building the buttresses an established grade will be taken for the top or offset. Each buttress shall be filled continuously up to the top or offset. Steel rods and pins shall be imbedded in the buttresses as shown on the plans.

The deck shall then be laid to the top or to the point of said offset. After 48 hours, if the concrete is sufficiently set, the forms may be removed and used over again. If there is more than one offset in each buttress, each section of each buttress up to the next higher offset shall be built continuously, and the deck laid as before.

**13. DECK.** The deck shall be laid in longitudinal sections of a width to constitute not more than one day's work. Every section shall end at the middle of a buttress.

**14. STEEL.** Steel rods shall be imbedded in the concrete of the deck, apron, base, beams and buttresses wherever shown in the plans. They shall be spaced as shown in the plans. The design, location, dimensions, and connections of the rods, also the section of steel of which they are composed and all secondary re-enforcement shall be as shown on the plans.

Steel rods shall be imbedded near the tension side of the deck, apron and beams. No reliance shall be placed on the adhesion between the steel and the concrete, but special rods (known as ) shall be used. The distance of the centre of the rods from the outside of the concrete shall not be less than the diameter of the rods. All steel must be free from paint and oil, and all scale shall be removed before imbedding in the concrete.

Steel wire stirrups, wire netting, expanded metal or other material as secondary re-enforcement shall be provided and imbedded in the concrete as called for in the plans.

**15. MOLDS OR FORMS.** All buttresses, abutments, deck, apron, beams, etc., shall be built in wooden forms. These forms shall be substantial and practically unyielding, with tight joints, and built to the proper dimensions for the work intended. The inside surface of the forms shall be of planed and smooth lumber. When the work is complete, all forms shall remain the property of the Ambursen Hydraulic Construction Company.

**16. FINISHING.** The concrete shall be rammed directly against the molds and worked down at the faces of the molds with a fork or spade, and after the molds have been removed all exposed surfaces where necessary shall be floated to a smooth finish with a semi-liquid mortar composed of one part of cement and two parts sand, care being taken that no body of mortar is left on the face, sufficient only being used to fill the pores and give a smooth finish.

The crest of the dam shall be re-enforced in thickness as shown in the plans, and shall be finished with a layer of mortar composed of one part of cement and three parts of sand, to a width and thickness indicated on the plans. This finishing layer must be put on before the concrete under it has set.

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OWNER

**9. CARE OF FINISHED WORK.** Particular care shall be taken of finished work as the work progresses, and the same shall be covered with plank or canvas while setting, if necessary to protect it from the weather. If necessary the concrete shall be thoroughly wet down every 24 hours for at least six days after completion.

**10. CONNECTIONS.** In connecting concrete already set with new concrete, the surface shall be cleaned and roughened, and mopped with a mortar composed of one part cement and one part sand to cement the parts together.

Each course shall be left somewhat rough to insure bonding to the next course above; and if it be already set, it shall be thoroughly cleaned and dampened before the next course is placed upon it. The work shall be carried up in sections of convenient lengths and, so far as practicable, complete without intermission.

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**16. FINISHING.** The concrete shall be rammed directly against the molds and worked down at the faces of the molds with a fork or spade, and after the molds have been removed all exposed surfaces where necessary shall be floated to a smooth finish with a semi-liquid mortar composed of one part of cement and two parts sand, care being taken that no body of mortar is left on the face, sufficient only being used to fill the pores and give a smooth finish.

The crest of the dam shall be re-enforced in thickness as shown in the plans, and shall be finished with a layer of mortar composed of one part of cement and three parts of sand, to a width and thickness indicated on the plans. This finishing layer must be put on before the concrete under it has set.

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**17. ERECTION.** The Contractor shall employ suitable and competent labor for every kind of work. The Contractor shall furnish all staging, centering, casing, forms and material of every kind required in the erection of the work ; also all plant, including boilers, engines, pumps, derricks, mixing machines, conveyors, barrows or other appliances necessary for carrying on all parts of the work. The Contractor shall build all coffer dams and do all necessary pumping unless otherwise agreed, and shall assume all risks for loss or damage to the work incurred by ice, floods, or other causes during construction.

**18. WORK EMBRACED BY CONTRACT.** The Contractor shall do all the work prescribed in these specifications and as shown on the plans, for the structure complete from out to out of shore abutments, unless otherwise modified in writing.

**19. CLEANING UP.** After the completion of the work, and before final acceptance thereof, the Contractor shall remove all temporary structures and rubbish, and leave the work in a neat condition.

**20. REMOVAL OF OLD DAM.** If the site of the proposed structure is occupied by an old dam, the same shall be removed by the Contractor, unless otherwise agreed. The material therein may be used by the Contractor at his option.

**21. EXTRA WORK.** The Contractor must be prepared to do any extra work that may be ordered in writing by the Owner, and for this he shall be paid at current contract rates for work of a similar character,—or if the extra work is of a class for which no rate is fixed by current contracts, he shall be paid the actual reasonable cost thereof, plus 15 per cent of said cost.

**22. ESTIMATES.** Unless otherwise provided, approximate estimates of the work done and material furnished shall be made on or about the last day of every month, and a valuation of the same in proportion to contract prices for the completed work shall be made, which sum shall be paid to the Contractor in cash on or about the fifth day of the following month, less a deduction of 15 per cent upon said valuation, which shall be retained until the final completion of the work.

**23. FINAL PAYMENT.** Upon the completion of the work, the Contractor shall be promptly paid the balance of the contract price which shall then remain due and unpaid.

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OWNER

# Proposal for a Concrete-Steel Gravity Dam.

(Under patents of Ambursen, Sayles and Church.)

Boston, April 17, 1906.

## STRIPPING.

All roots, turf, muck and vegetable matter shall be removed from the site of the dam before any work is begun on the dam.

## CORE WALL TRENCH.

The core wall and wing wall trenches are to be excavated to such a depth as shall secure a good foundation, and are to be close sheeted with two inch sheeting when over ten feet in depth, or where it may be necessary. Hand Pumps sufficient to keep these trenches clear of water during the progress of the work are to be provided by the Contractor.

## CONCRETE.

The core wall and cut-off walls, and the foundation of the wing walls are to be built of cement composed of Portland cement, one part; clean sharp sand, three parts; screenings of fine gravel, two parts; and gravel, not more than two and one-half inches in greatest dimensions, four parts.

Or the following mixture may be used;- Portland cement, one part; sand, three parts; gravel or screenings, two parts, with sound clean stones set into this mixture. The stones not to exceed two feet in longest dimensions, and to be tamped into the mortar so that at no point shall one stone be within two inches of any other stone or within one inch of the face of the wall.

## CORE WALL.

The core wall is to be built up between plank forms placed so as to bring the work to true lines and surfaces. After the concrete has become sufficiently set it is to be plastered on the up stream side with a coat of mortar, one-half inch thick, composed of one part Portland cement and one part sand, which when set will be washed over with a coat of neat cement grout. This wall shall be built so that the joints between successive layers shall be broken in the building.

## PAVING.

The interior slopes of the embankments are to be paved, the stones to be set on end and thoroughly rammed into place, on six inches of gravel, no stone of which shall be over one and one-half inches in diameter, the joints between the paving to be thoroughly chinked with wedge shaped spalls.

The wasteway is to be paved as shown with large stones set in concrete.

## EMBANKMENT.

The filling of the trench inside the core wall and all the embankment inside the core wall shall be of selected clay and gravel mixed in proportions which will be satisfactory. The material shall be carted from pits and shall be free from lumps or from stones more than two inches in diameter, spread layers.

CLOVER

thoroughly sprinkled and rolled with a grooved roller. No layer shall be allowed to dry before the next layer is supplied, and the sprinkling shall be so done as to avoid puddles or soft spots.

When impracticable to roll, the puddle shall be tamped. The embankment shall be finished to line before the paving is laid.

GRAVEL FILLING.

The filling on the lower side of the core wall and back of the wasteway walls, shall be of gravel of a quality satisfactory and thoroughly compacted by sprinkling. Soil is to be spread on the outside slope and top of the dam, finished to grade and sown with oats and grass seed.

OWNER

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Change of name 41  
PROPOSAL FOR A CONCRETE-STEEL GRAVITY DAM.

(Under patents of Ambursen, Sayles and Church.)

The Consolidated Water Co. of Utica,  
234 Genesee Street,  
Utica, N. Y.

Gentlemen:

We, The Ambursen Hydraulic Construction Co., of Boston, Mass., hereby propose to you, The Consolidated Water Co. of Utica, N. Y., to design and build for you a concrete-steel dam with concrete-steel cut-off wall and with concrete-steel abutments and core walls with earth embankments, with measuring weir within the structure, and log sluice as you shall order, all substantially as shown on plan prepared by us #6-30, dated March 21, 1906, and in accordance with specifications hereto attached,--said plan and specifications being made a part of this instrument. The location of this dam to be upon what is known as The Upper Gray site on the Black Creek, which has been indicated on a certain profile furnished to us by you,--upon the following terms:

For the sum of \$13,240, we will prepare and furnish all plans and schedules of material required; furnish all reinforcing steel rods f. o. b. cars Poland; furnish all lumber for forms and staging for concrete (but not for apron or sheeting and piling for trenches) either at Poland or Gray mill; furnish the use of all the necessary plant, including boilers, engines, derricks, stone crushers, and all necessary tools and machinery, with the exception of steam pumps, pile drivers, and horses and carts, same to be de-

livered by us at Poland; and furnish the services of a competent superintendent, including his traveling expenses and board, from the beginning to the completion of the work; and furnish also the services of a competent engineer of the company, skilled in the construction of dams, who shall visit and assist in the work, as often as is necessary for its proper performance and supervision. We will begin the work immediately after the acceptance of this proposal, and prosecute the same diligently and continuously, and complete the same at the earliest practicable date; it being estimated that the work should be completed, ready for use, within six months from the signing of the contract.

The above is for an extension dam having a present height of 30' above the floor and designed to carry an ultimate height of 40' and sustain a flood of 6' on the crest, all as indicated upon the preliminary plan above referred to.

The terms of payment of the above sum, which terms you hereby accept, shall be

- 20% when the plant is delivered as above stated
- 20% when the steel and lumber are delivered as above stated
- 15% when one-third of the dam is completed by yardage estimate
- 15% when two-thirds of the dam is completed by yardage estimate
- 15% when the dam is fully completed
- 15% thirty days after the dam is fully completed

All other material not above specified shall be purchased by you on requisitions prepared by us or ordered by us as agents on your account as you may instruct, and bills for same in either case are to be paid at net cost by you without profit to us.

All other bills for labor, freights, cartages and incidentals shall be paid by you at net cost without profit to us on accounts audited and approved by us.

OWNER

Any discounts which we may be able to negotiate on any materials ordered for you or for your account shall be wholly for your benefit, our sole compensation lying within the sum of \$13,240, above named.

It is mutually understood that none of the above mentioned payments shall be made by you to us until we have delivered to you an indemnity bond, with approved surety company, in the sum of \$20,000, which shall guarantee the stability, tightness and permanence of all the concrete and steel work in the rollway with its walls, floor and abutments, shown on the above mentioned preliminary plan, for the term of two years after the completion of the entire work.

We estimate the cost of the same to be \$35,400, which estimate is based upon the present price of cement, said price being not more than \$2.4 per barrel delivered at the site of the dam,--which sum of \$35,400 includes the cost of the coffer dam and the handling of the water, also the earth excavation and the back fill of the core wall to the depth as shown on the above mentioned plan, also the stone paving of the water slope and wasteway. The estimate of \$35,400 further includes the sum of \$13,240 named as our contract portion of the work, and contemplates the completed dam ready for use.

It is mutually agreed that the core wall and cut-off wall shall be carried to a depth which will insure a good foundation and an effectual prevention of the passage of any water beneath the dam,--and as the depth to which the core wall shall be carried is not at present determined, and as the method of its construction has not as yet been deter-

OWNER

mined, it is mutually agreed that such depth and methods shall be adopted as are mutually satisfactory to the President of the Ambursen Hydraulic Construction Co., and the President of the Consolidated Water Co.

In consideration of the above mentioned work to be performed on our part, and in consideration of the above mentioned payments to be made on your part, it is hereby agreed that your acceptance under your hand and seal of this proposal constitutes a contract between us.

Respectfully submitted,  
AMBURSEN HYDRAULIC CONSTRUCTION CO.

By

C. N. Eghe

Secretary.

Attest:

[Signature]  
Secretary.

Accepted,

THE CONSOLIDATED WATER CO. OF UTICA,

By

[Signature]  
President.

Attest:

[Signature]  
Secretary.

OWNER

April 22 '16  
R24-2

THE WATER COMPANY'S NEW STORAGE RESERVOIR AT GRAY, HERKIMER CO., N.Y.

In keeping with its progressive methods, the Consolidated Water Company is making preparations to construct a large storage Reservoir at Bennett's Mill on Black Creek about one and one-half miles above the village of Gray. Gray is a small village of not over 200 inhabitants, located just above the Forks in Black Creek at a point about twenty-five miles northeast of Utica. Its only industry now is a steam saw mill. In the past its largest mill produced clothespins, but the old clothespin factory has been abandoned these many years. To the northeast of Gray Black Creek divides into three branches which traverse a wild country devoted entirely to the lumbermen, hunters, fishermen, and those who seek retirement from the cares of the world during the summer time. Jerseyfield Lake, which covers about 1000 acres stands at the head of the north branch. The other branches are fed by numerous lakes which lie hidden in the region hitherto known only to the hunter and trapper.

In order to secure the water supply of West Canada-Creek for the City of Utica, it has been necessary for the Water Company to make compensation to the owners of mills and water powers at a point below its Intake above Hinckley. This is the main purpose of those storage Reservoirs. Not the least useful feature of them will be the relief which it will afford to the people of Herkimer by catching flood waters in the spring time. The people of Herkimer know well the trials that come to them during the freshet season, and will view with satisfaction any effort made on the part of the Water Company to afford such relief. Even though the Water Company does divert from the creek these surplus waters which are nothing but a nuisance to Herkimer inhabitants, it will turn them to good account for the supply of the City of Utica, its neighbor and sister city in the Mohawk Valley.

OWNER

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The Company will draw from this reservoir during periods of low flow when the waters flowing into West Canada Creek are insufficient to supply the mills, and there is, therefore, no water running to waste over the mill dams. In order to divert waters from the Creek, the Company must draw from its storage reservoirs at such times whatever water it may take through its pipe line to Utica. For the purpose of carrying out this scheme, the Company during the past year purchased two large reservoir basins above Gray on the south branch of Black Creek. The lower basin, having a dam at Gray Village, spreads out over about 300 acres. At the head of this basin where the shore line of the valley draws together into a narrow gorge stands the Bennett saw mill. At this point an old log dam exists with a very old fashioned saw mill just below it. The site is a picturesque one. One of those old covered wooden bridges spans the stream where the road crosses it. Above the present dam there lies a broad expanse of flow ground. A dam of the ultimate possible height at this point would flood about 650 acres, for the most part densely wooded. All of these woods will have to be cleared off. The good timber has been sold; the underbrush will be burned. When a dam has been erected here, it will form a broad lake. To the eye of an observer standing on one of the surrounding hills it will present a very irregular contour with a small island about one-quarter of a mile above the dam. There will be many long reaches and bays following the ravines which enter the basin on both sides at its head. Two main streams flow into the basin directly at the upper end, one Yellow Brook, the other the main stream of Black Creek, so that at its upper end the basin looks not unlike the tail of a fish. Thus it will form a beautiful sheet of water for pleasure purposes, situated in a charming region where fishing and game abound. It will be next in size to Jersey-field Lake, and quite the largest lake in the West Canada watershed, fully resist any ice pressure - 8 ft. side of blow due to

if we except the West Canada Lakes and Monnedaga Lake.

The plan adopted by the Company is not to erect a dam to the full height at present, but to a height of 30 feet, leaving 10 feet to be added at some future time. Probably the most interesting feature and one entirely new to this section of the country is the type of dam which has been adopted. It is neither of wood, nor stone, nor yet wholly of earth, but all three together with steel added. The concrete construction is a new departure in dams. People are quite familiar now with the use of concrete made of stone and Portland cement, and reinforced with steel rods of peculiar shape which are set in the body of the concrete. Today, hundreds and even thousands of buildings are being constructed in this manner, to say nothing of all classes of public works, bridges, reservoirs, sewers, aqueducts, and other similar structures, which can be more cheaply and durably built in this way. The City of Mexico for instance is now building its new aqueduct entirely in this manner, drawing its supply from living streams many miles from the great City on the plateau.

on bridges, Concrete steel construction, as applied to dams, brings into play the hydrostatic principle whereby the weight of the water itself is used to hold the dam in place, thereby doing away with the necessity of solid masonry structures, such as hitherto have been regarded as indispensable. Such a dam built simply of concrete without the steel reinforcement would be crushed together like an eggshell simply by the weight of the water. The saving feature is the system of steel rods bedded in the concrete and placed about 6 inches apart. The shell of the dam so constructed varies from 8 inches to 10 inches in thickness, a very different structure from a solid masonry dam with a base 25 feet wide. The deck of the dam so constructed, will not only withstand all the hydrostatic pressure due to the weight of the water upon it, but will successfully resist any ice pressures or any accidental blow due to the

- 3 -

passage of logs, or any unusual strain that may be brought to bear upon it.

For the original idea as to the shape and the general method of the construction of this type of dam, we are indebted to Mr. Ambursen, a young Norwegian engineer, who has given the name to the Ambursen Hydraulic Construction Company of Boston, a concern which is now building dams in all parts of the country in accordance with this new method.

The general shape of the dam is triangular, the longest side being the base, the top or apex of the triangle forming the crest of the dam. The base is called the floor, the upstream side, the deck, the downstream side, the apron, and the curved railway at the bottom, the bucket. The water flowing over the top of the dam slides gently down the apron being deflected at the bottom by the bucket into a film flowing horizontally, so that when floods pass over the dam they will not scour the bottom of the stream below it. The dam is hollow, and this gives an opportunity for many advantages which are being utilized in various ways. For instance dams of this kind are sometimes used in place of bridges, forming a covered way for travel across the stream. This type also gives an opportunity for housing power plants, thus saving the cost of building a power house. Advantage is also taken of the vacuum created by the overpassing water to apply a strong draught to the water wheels, and thus materially increase their power.

These are some of the special benefits of this type of dam. It was especially adapted to the situation at Upper Gray, owing to the fact that this kind of a dam could be built on the gravel foundation found at that place. The Water Company has made a contract with the Ambursen Hydraulic Construction Company for the construction of a dam 30 feet in height with a spillway 100 feet long. The preliminary work has already been started, and will be pushed with vigor. The general method of construction is practically the same

as that employed in the erection of concrete steel bridges and similar structures, broken stone or gravel concrete being used for the purpose. The total span from one end of the dam to the other is 385 feet of which about 105 feet is of concrete construction at the spillway. On either side of the spillway a core wall of concrete extends deep into the bank on both sides for an additional distance of 180 feet on the north side, and about 100 feet on the south side. This core wall will be lodged in a gravel embankment rising to a height of 6 feet above the crest of the spillway, so as to allow for the highest floods that are known to pass down Black Creek in the freshet season. These embankments and core wall will be built in accordance with the practice usually followed in erecting reservoir embankments, the inboard slope being faced with a slope wall made of large field stone to prevent erosion.

The interior of the dam will be utilized to house the valves and measuring weirs that are necessary for drawing water from the basin for the purposes for which it is constructed. The hollow dam affords an admirable opportunity for all this apparatus, protecting it from the weather and also the logs and ice which may come down in times of flood.

The superintendent in charge of this work on the ground will be Mr. John A. Kellogg. The engineer, who will visit the work occasionally, will be Mr. Ambursen himself, the designer of this class of dams. The construction work will be generally supervised by Mr. C. H. Eglee, a contractor of Boston of long standing reputation, General Manager of the Ambursen Hydraulic Construction Company. Messrs. Kellogg and Ambursen are now on the site at Gray, laying out the work. Mr. Eglee is at Horseshoe on the M. & N. R. R., looking after the completion of a similar dam built for power purposes on the A. A. Low Estate. All of these gentlemen are men of energy, and will make it their business to push the work to rapid completion.

The capacity of this great basin, one of the largest in the Black Creek watershed, will exceed all the combined

reservoirs of the Water Company at or near Utica as they stand  
any. It will furnish sufficient compensation to permit the  
company to draw 10 million gallons per day through its 24 inch  
pipe line from West Canada Creek to the Deerfield Reservoir.

Just at present the pipe line for the last five  
miles between the Marcy Summit and the Deerfield Reservoir is a  
18 inch main, having a capacity of about 6 millions per day. It  
is the Company's intention to lay a larger main whenever the  
additional water may be required.

The 24 inch pipe line between Hinckley and  
Prospect is still uncompleted. Contract for this work was signed  
~~Monday~~ <sup>Thursday</sup> with Harry W. Roberts, the well known contractor, of  
this city, who will proceed at once with the work, and will have  
the same completed by the first of September of this year. The  
connection with the Deerfield Reservoir will be made, and whatever  
work was left undone during the past year will be completed by the  
Water Company's employees.

With the growth of the City of Utica, the  
present dam will be raised and other storage reservoirs will be  
constructed as fast as they are needed. Thus the Water Company  
is laying the foundations broad and deep for the water system of  
the City of Utica, so far as it is possible to foresee its re-  
quirements for a hundred years to come.

# From the fact that the West Canada water is the  
best that can be obtained in the State of New York, and is in every  
way suitable for all public and private uses, the city is certainly  
to be congratulated on the outlook.

PROGRESS REPORTS OF  
WILLIAM S. BACOT, ENGINEER,  
AND  
A. B. TRACY, ASSISTANT ENGINEER,  
ON  
STORAGE RESERVOIR AND DAM  
AT GRAY, N. Y.

DATED, MAY 28th, 1906.

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CONSOLIDATED WATER COMPANY OF UTICA N Y

NO 234 GENESEE STREET.

UTICA. N. Y. May 28th, 1906.

SUBJECT, STORAGE RESERVOIR AT GRAY.

Mr. John V. Cockcroft,

Pres't., Consolidated Water Company of Utica, N. Y.,  
Utica, N. Y.

My dear Sir:-

I submit for your consideration a report made to me by Mr. A. B. Tracy, Assistant Engineer, in charge of construction of the dam at Gray, N. Y. This report purports to be a statement of the work done from its inception to the 25th inst. Although the results accomplished so far are not very considerable, it must be remembered that most of it has been in the nature of preparation, such as the transportation and installation of the plant, the organization of the working force, establishment of quarters for the Engineers, Superintendent, and Foremen, as well as the laborers, the construction of forms for the concrete work, the removal of the old timber dam, the clearing and stripping of the site of the new dam, the construction of the cofferdam, and a large amount of other work that need not be detailed.

Mr. Tracy gives a clear view of the whole situation. It is a satisfaction to feel that we have the right man for the position.

OLIVER

F3-20

The most important fact which he brings out is in regard to the stratum of boulders found in the bed of the Creek, immediately beneath the silt and loose materials in the bottom of the Creek. Mr. Tracy says "the excavation along the channel has exposed from 18 inches to 2 feet of mud, muck, and river silt, then a very fine dense, clayey, sand, completely interlarded with boulders of all sizes. It would be hardly possible for boulders to lay thicker. \* \* \* \* \* If this material proves to be thick enough, I believe it is practically impervious to water, and will sustain a load without compression in excess of what Mr. Ambursen claims is required for their dam".

If Mr. Tracy's expectations are realized in regard to the materials in the bed of the Creek, a very stable foundation can be secured for the dam, and it will probably not be necessary to sink the cut-off walls to a greater depth than 10 feet, pursuant to the original intention of the projectors of this dam.

In regard to the auxiliary apparatus required for measuring the discharge of compensating water from the dam, I have on my part to report that I have consulted with Mr. Ambursen, and that he has submitted to me a plan which briefly consists of three (3) 24 inch discharge pipes set in the bottom of the dam, one in each panel between the buttresses at the south end of the spillway. To these Light Pressure Stop Valves are attached for their proper operation. Each panel contains

CLOMER

a tank which was intended to act as a stilling chamber to bring the water to rest before it reached the gauge weir. Stop walls were inserted at two points and a deflector immediately in front of the discharge pipe. Each gauge weir was intended to carry about ten million gallons per day, giving a total capacity of thirty million gallons per day for the three weirs. Three additional discharge pipes with blank flanges attached, under this plan, were to be built into the three adjacent panels for future use.

This plan presented some objectionable points. In this connection I consulted with Mr. R. E. Horton, Hydraulic Engineer, and he submitted some modified plans. The latter, however, involved an increased cost of construction, so that I did not follow Mr. Horton's plan, but adopted his suggestion in part. The chief modification was the raising of the weir to a height sufficient to keep the water at one level in the tank, and about 6 feet above the general floor level of the dam, thus avoiding the drops at the cut-off walls, and the constant disturbance of the flow of the water in the tank. In place of the cut-off walls two baffle board racks were inserted; the deflector was retained but raised to a higher level.

I returned the modified plan, together with a sketch of the gauge weir to the Ambursen Company, requesting them to draw up a detailed plan of the same for final submission and adoption. This has not yet been returned to us.

OWNER

I may say in passing that the new plan cuts out two of the discharge pipes, making the total number 4 in all, instead of 6, the number of weirs being 2, and the pipe with blank flanges 2, thus affording some saving in first cost. Owing to the preparation of these detailed plans, the pipes have not yet been ordered, nor have the Valves. I have a proposal from the Rensselaer Mfg. Co. to furnish these Valves, which is herewith submitted. Similar proposals should be asked from the Eddy Valve Mfg. Co. and the Ludlow Valve Mfg. Co.

You will note that I have recommended the setting of an Auxiliary Single Disc Valve on each discharge pipe. The proper office of this Valve is to cut off the flow, in case repairs are for any reason required in the main valve. Unless some such device is provided, in case of accident to any one of the Valves, it would be necessary to empty the reservoir before it could be repaired, or else to find a means of plugging the pipe at the influent end. As there are only two of these Auxiliary Valves, it seems to me a wise precaution to provide them.

Mr. Tracy, at my suggestion, has taken charge of the Company's lands in both basins at Gray, and so far as now appears, is handling that matter satisfactorily. He is also giving general oversight to the contract work at Prospect, so far as the regulation of the lines and grades are concerned.

In the construction of the embankments at the Gray dam some of the plants, such as self-dumping wagons, wheel scrapers, drag scrapers, etc., which the Company now own, will be found very useful and economical. I have sent five of these wagons, six wheel scrapers, and several drag scrapers, to Gray for this purpose.

Mr. Tracy has also taken charge of the clearing of the basin at Gray. The flow line has been marked out by a line of stakes, and the trees have been blazed along the line.

I have drawn up a set of specifications and a form of notice to Contractors for the letting of this work. Mr. Tracy is reviewing these specifications in the light of local conditions, and the same will be ready for the submission to Contractors within a few days. The notice is now being published in the Utica and Herkimer papers. The entire job can best be let at a lump sum, reserving a section of the bed of the basin, immediately adjacent to the dam, to be cleared by the Company's force of men at the dam. This measure is to provide for those times when the work at the dam becomes slack, due to conditions of weather, flood, and other interruptions in the work, which will make it necessary at times to lay off the force, in whole or in part. The clearing work will afford an opportunity to keep the men busy continuously, and thus keep up a feeling of satisfaction among the men.

OWNER

The contract and specifications briefly provide for the cutting of all standing timber and underbrush; also tall weeds, the burning or removal of the same prior to August 1st, 1906. A copy of the contract and specifications is herewith submitted to you for final approval.

By the first of July, I hope to be able to report the completion of the foundations of the spillway of the dam, together with considerable work accomplished on the embankments. The work of clearing should have been advanced by that time to a considerable extent.

Respectfully submitted,



Engineer.

OWNER

Gray, N. Y., May 26, 1906.

Mr. Wm.S. Bacot,

Engineer, Consolidated Water Co.,

Utica, N. Y.

Dear Sir:-

Following is a report of work accomplished at Upper Gray from its inception to date:- Active work was commenced on the morning of May 17th. Prior to that date a considerable amount of preliminary work had been accomplished. The red barn belonging formerly to the Carpenter place has had a carpenters shop and office installed on the upper floor, the lower floor being used as store house for tools. Boxes have been constructed on the outside also for storage of tools. The shed of the Carpenter house has been rigged for a blacksmith shop and equipment installed. Some reinforcement work on the floors of the Carpenter house was done with the idea of converting it into a cement store house, but after the letting of the contract for the crushed stone with Law Brothers this idea was abandoned and the basement of the saw mill utilized. The Carpenter house is now occupied by Law Brothers as Headquarters, and a boarding house for his employees. The upper floor of the saw mill has been made into a living room and commissary for the Italian laborers. A partition separating the store from the living room has been put in and the store fitted up with shelves &c. The living room has been fitted with bunks having a capacity of from 75 to 100 Italians, the necessary tables benches, &c., and a cooking range. A new covering of double ply tarred paper has been placed on the northerly roof of mill and about one-half of the southerly roof has been treated in a like manner to prevent

CWNER

leakage. The Frank Bunce house has received necessary cleaning, paper and paint to make it habitable as a residence for the Contractors Superintendent, Mr. Kellogg. About 8000' B. M. of lumber have been worked into buttress forms. The largest part of the plant is on the ground ready for installation, consisting of a derrick and fittings, 65' boom, a double drum hoisting engine with separate swinging gear, a 20 horse power horizontal boiler, a cubical concrete mixer of 1 cu. yd. capacity with vertical horse power engine attached for running the same, and an assortment of the necessary small tools. About 40 or 50 yards of sand have been hauled from the Crocker Hill on the Hurricane, but have not been able to reduce the cost to us here at the dam site below \$1.00 or \$1.10 per yard.

Further explorations have revealed some sand at Lower Gray, but I am of the opinion that it is limited in quantity and will be difficult to secure without mixing with clay. Since the beginning of active work, May 17, work has been accomplished as follows:-

The southerly or easterly embankment site has been cleared of trees and brush and a large part of the loam and vegetable matter removed and piled in spoil banks. The westerly embankment site has been practically stripped of loam and vegetable matter, and spoiled. Excavation for core wall trench, westerly embankment, has been commenced and carried to a point that seems to assure a hardpan foundation at a depth of from 4' to 12' below surface. This excavation has been carried on between Stations 1 + 06 and 2 + 00. Under the northerly end of the spillway between Sta. 2 + 95 and 3 + 20 a channel 25' in width is being

CLOVER

excavated at right angles to the axis of the dam. Sta. 2 + 95 is at the outside face of the westerly abutment and Sta. 3 + 20 is between Buttresses #2 & 3. This channel is to carry the stream while the remainder of the spillway between Buttress #3 and the easterly abutment is in process of construction. The excavation along this channel has exposed from 18" to 2' of mud, muck, and river silt, then a very fine, dense, clayey, sand completely inter-  
larded with boulders of all sizes. It would be hardly possible for boulders to lay thicker. I am not surprised that wash drill borings were productive of unsatisfactory results at this point. Nothing but a core drill could accomplish results under the conditions which we have exposed. If this material proves to be thick enough, I believe it is practically impervious to water, and will sustain a load without compression in excess of what Mr. Ambursen claims is required for their dam. This excavation is now at grade 61.5 or thereabouts, and will allow us to raise the floor of the spillway at that end thus economizing in excavation and concrete. This will necessitate putting the measuring chambers at the easterly end of the dam. The old mill dam has been destroyed and removed, and the mill pond drained. A crib cofferdam has been constructed, swung into position at an angle of 30° with the axis of present channel and anchored in position. The face has been planked with the exception of the two openings through which the stream is now flowing. "A" frames have been placed in position along the easterly face of the diversion channel for more than half the distance, 140', ready for the face planking. The coming week should see the stream passing through the diverting

COVER

channel, the derrick installed inside the cofferdam ready for handling excavation and concrete for the portion of the spillway between Buttress #3 and the easterly abutment Sta. 4 + 00. The excavation from the diversion channel has been wasted below dam, except boulders which go to stone crusher.

Law Brothers have their plant installed, and commenced active operations yesterday, May 25. They have a force at present of 6 men and 4 horses.

Henry Snyder is, so far, carrying out his contract very satisfactorily, having hauled in the vicinity of 100 tons of material during the past month. He has had from 2 to 9 horses on the road.

Our force at present is 46 men and 10 horses.

Yours very truly,

(Signed)

A. B. Tracy.

PROGRESS REPORTS OF  
WILLIAM S. BACOT, ENGINEER,  
AND  
A. B. TRACY, ASSISTANT ENGINEER,  
ON  
STORAGE RESERVOIR AND DAM  
AT GRAY, N. Y.

DATED, JUNE 12th, 1906.

OWNER

DR 3-8

CONSOLIDATED WATER COMPANY OF UTICA, N. Y.

NO 234 GENESEE STREET.

UTICA, N. Y. June 12th, 1906.

SUBJECT. STORAGE RESERVOIR AT GRAY.

Mr. John V. Cockcroft,  
Pres't. Consolidated Water Company,  
Utica, N. Y.

Dear Sir:-

I append report of Mr. A. B. Tracy,  
Assistant Engineer, on work done at the dam of the Reservoir  
at Upper Gray during the week ended June 8th.

It is all preparatory to the general  
work of constructing the dam. An abundance of materials are  
now on the ground, so that when the work fairly well commences,  
it should go forward rapidly.

Your special attention is called to the  
necessity of undertaking the clearing of the Reservoir basin  
early in the near future. Only two proposals were received,  
and these I herewith submit. The total of one is \$11,500, and  
the other \$16,000. Both of these are too high to be accepted,  
and I, therefore, recommend the work be undertaken by the Company,  
employing its own force.

The Ambursen Company offers to provide  
us with an organized force of Italians, which they are now em-  
ploying at Horseshoe, N. Y. It is represented that this gang

OWNER

is trained in that class of work, and in every way fitted for undertaking the job. This plan is presented for your favorable consideration. It is my opinion that it would cost less to do the work in this way, than in any other, besides placing the work directly in control of the Company.

During the past week, I have had correspondence with the Ambursen Company in relation to the construction of the abutments of the dam. This has resulted in the submission by that Company of a modified plan, herewith submitted, which will to some extent increase the cost.

The Ambursen Company's estimate has not yet been turned in, but it is my opinion that the conditions demand the adoption of a modified construction. Briefly, it consists in extending the abutments on the inboard and outboard slopes, so as to accommodate a one and one-half slope instead of a one to one slope. The details of this plan, I will further explain to you personally.

Mr. Eglee of the Ambursen Company came to the office yesterday, and urged the adoption of this plan, and we agreed as to the practical necessity of it. He is now at the site of the dam, giving his personal attention to that work.

Arrangements have been made for the four discharge pipes to be set in the dam, and the same will be ready to place before the construction reaches that stage.

-----3.

Mr. Tracy is continuing his work in connection with the Company's real estate interests in that section.

Respectfully submitted,

*W. S. Barst*

Engineer.

CLONER

F3-33

Gray, N. Y., June 9, 1906.

Mr. W. S. Bacot,  
Engineer, Consolidated Water Co.,  
Utica, N. Y.

Dear Sir:-

Below find report of work accomplished at  
the Upper Gray Site for week ending Friday night, June 8th, 1906.

The principal work at the dam site has been  
the installing of plant, crushing stone, hauling sand and other  
materials. Progress on the installation of the machinery has  
been fairly good. Foundations have been excavated for the heavy  
hoisting engine, concrete base constructed, and the engine set,  
steam being raised for the first time Thursday. A concrete  
foundation has been prepared for the foot block to take the 80'  
derrick mast, the mast raised and stepped, anchorages located and  
set for the five supporting guys, guys strung out and attached to  
mast head, the stick now standing ready for the final plumbing  
and tightening of guys. A 35' gin pole was raised, guyed and  
used for the hoisting of the mast. I had hoped to see the derrick  
in active operation by the close of the week, on excavation within  
the coffer-dam, still the raising of an 80' stick is no small task,  
which in the instance has been well and economically accomplished

OWNER

without the aid of expensive riggers or tackle. The concrete mixer and engine have been set in position, a dumping platform and a loading platform and hopper constructed for the same. A track is under construction running from the loading platform and hopper to the sand and stone piles. A car also under construction will run on this track conveying the loaded guage boxes from the stone and sand piles to the hopper, from which the mixer will be directly charged. The mixer will discharge into buckets on the dumping platform, buckets to be picked up by the derrick and conveyed to such parts of the spillway as may be under construction. The tarred paper roof on the old saw-mill, the headquarters for the Italian laborers has been completed.

The Law Brothers crushing plant has run without interruption except for inclement weather, throughout the week. They have employed an average force of 7 men and 7 horses. Measurements made the first of June and computed during the past week showed 325 yards of crushed stone on the ground at that date. Other materials are coming steadily forward, the third carload of cement should be <sup>stored</sup> on the ground early in the coming week, making 510 barrels on the ground, so that there should be no shortage of materials when construction work is well under way. Estimates made this week show that Henry Snyder, who has the contract for hauling supplies from Poland, hauled nearly 150 tons during the

CLONER

-----3.

month of May.

During the same period, 99 yards of sand were hauled by our day force of teams. The amount received being practically equally divided between the pits opened at Crocker Hill and in the Bullock lot at Lower Gray. We have over 190 yards on the ground at the present time. The average day force employed on the dam work proper for the week has been 20 men and 7 horses.

#### UPPER GRAY RESERVOIR.

The surplus day force from the dam has been engaged felling and piling trees and brush along the northerly side of the reservoir through the John Bennett piece and up into the E. A. Bunce lot, an average force of 20 men being employed for the week. The prospective bidders on the work have been notified during the week of the extension of time for the completion of the work from August 1st to September 15th, and requested to have their new bids in by Saturday, June 9th. If this clearing problem, as seems probable now, resolves itself into a question of leaving uncleared, or clearing by a day force, and the latter phase of the question is adopted, vigorous steps will need to be taken soon along the line of procuring, organizing and equipping the necessary force, as the work to be accomplished is no light task.

Yours very truly,

(Signed) A. B. Tracy.

EXNER

(NOTICE: After filling out one of these forms as completely as possible for each dam in your district, return it at once to the Conservation Commission, Albany.)

STATE OF NEW YORK  
CONSERVATION COMMISSION  
ALBANY

## DAM REPORT

141

J

7/20/1915.  
(Date)

696 Mohawk

CONSERVATION COMMISSION,

DIVISION OF INLAND WATERS.

GENTLEMEN:

I have the honor to make the following report in relation to the structure known as the Tracy Dam.

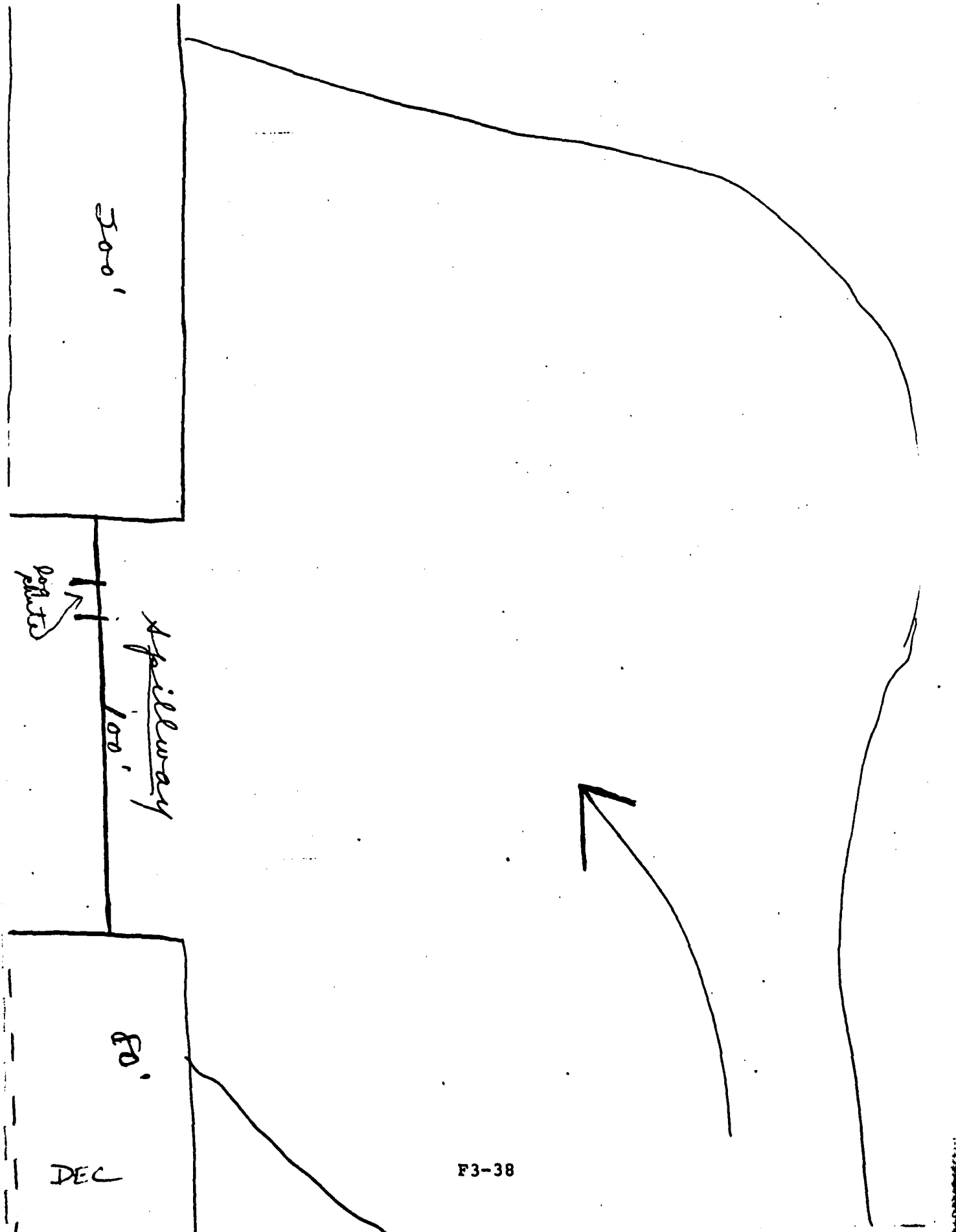
This dam is situated upon the Black Creek (Give name of stream)  
in the Town of Norway, Herkimer County,  
about 1 mile (State distance) from the Village of Esray.  
The distance down (Up or down) stream from the dam, to the highway bridge,  
is about 200 yards. (Give name of nearest important stream or of a bridge)  
(State distance)

The dam is now owned by Utica Water Co., Utica, N.Y. (Give name in full)  
and was built in or about the year 1906, and was extensively repaired or reconstructed during the year \_\_\_\_\_.

As it now stands, the spillway portion of this dam is built of concrete & plank (State whether of masonry, concrete or timber)  
and the other portions are built of concrete, earth & stone.  
(State whether of masonry, concrete, earth or timber with or without rock fill)

As nearly as I can learn, the character of the foundation bed under the spillway portion of the dam is gravel and under the remaining portions such foundation bed is gravel.

DEC



DEC

The total length of this dam is 380 feet. The spillway or waste-weir portion, is about 100 feet long, and the crest of the spillway is about 6 feet below the top of the dam.

The number, size and location of discharge pipes, waste pipes or gates which may be used for drawing off the water from behind the dam, are as follows: one log chute 6' x 6' top of dam as shown

State briefly, in the space below, whether, in your judgment, this dam is in good condition, or bad condition, describing particularly any leaks or cracks which you may have observed.)

This dam is in good condition - no visible cracks and no leaks.

The bridge just below together with 7 or 8 residences would be damaged if this dam should go with. Pond very large so damage might be widespread.



Reported by

C. W. H. Douglass,  
(Signature)

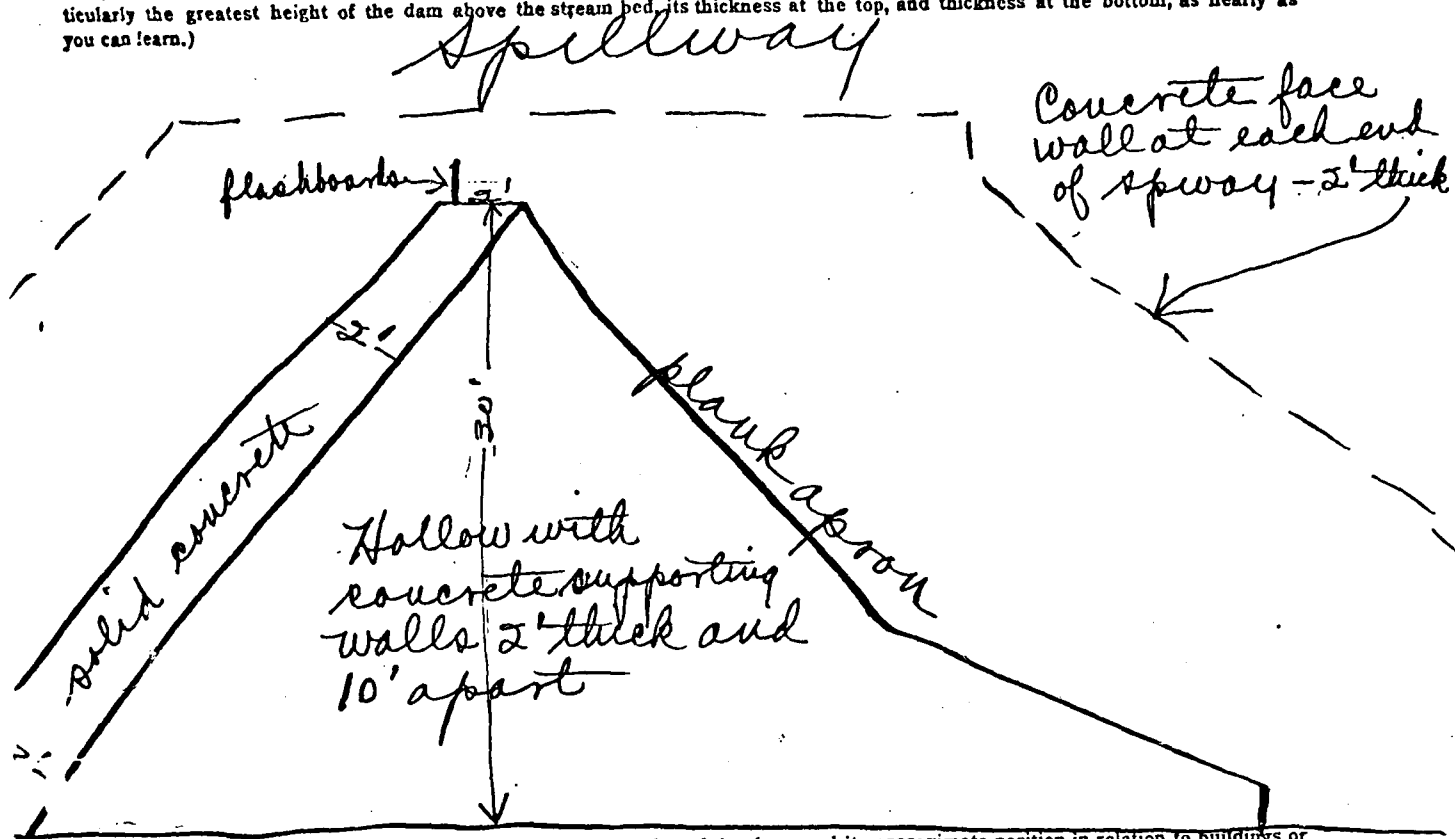
115 Standard St.,  
(Address—Street and number, P. O. Box or R. F. D. route)

Syracuse, N. Y.  
(Name of place)

(SEE OTHER SIDE)

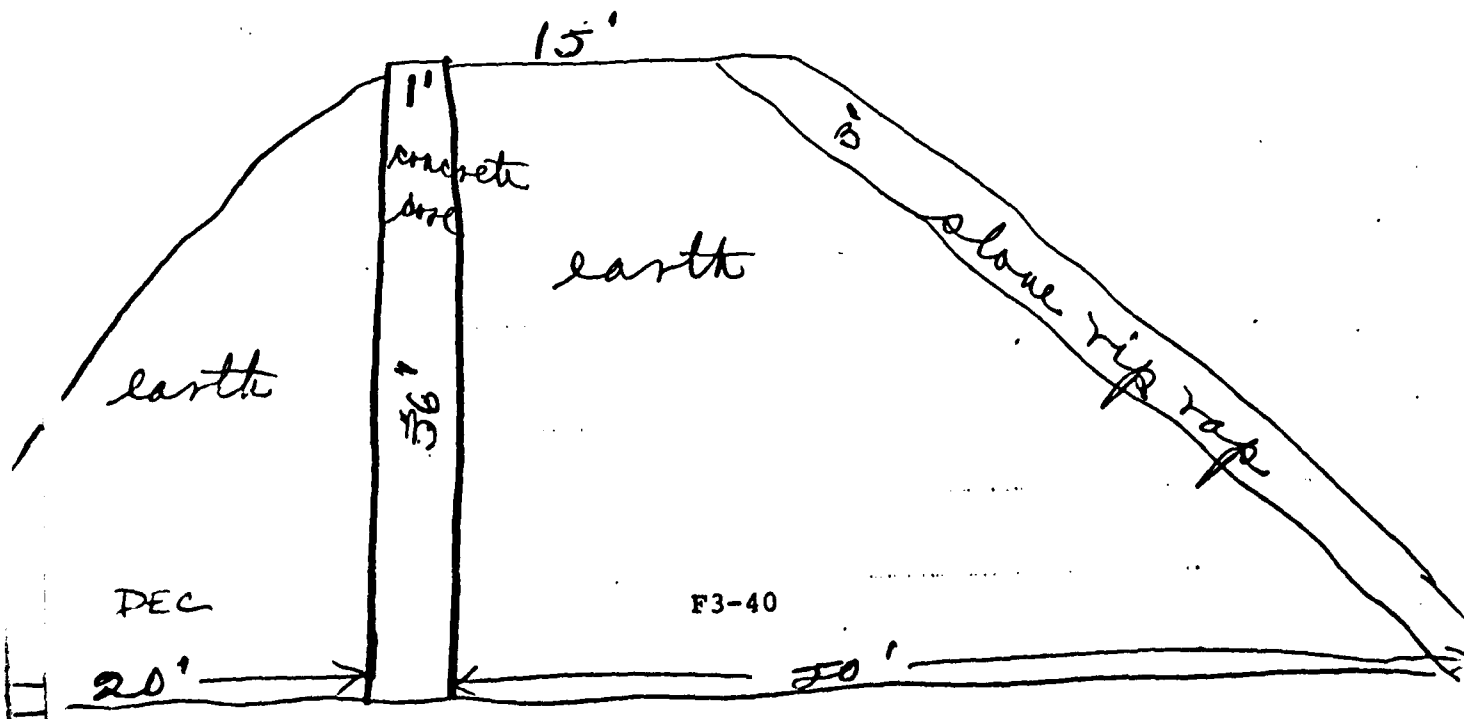
DEC

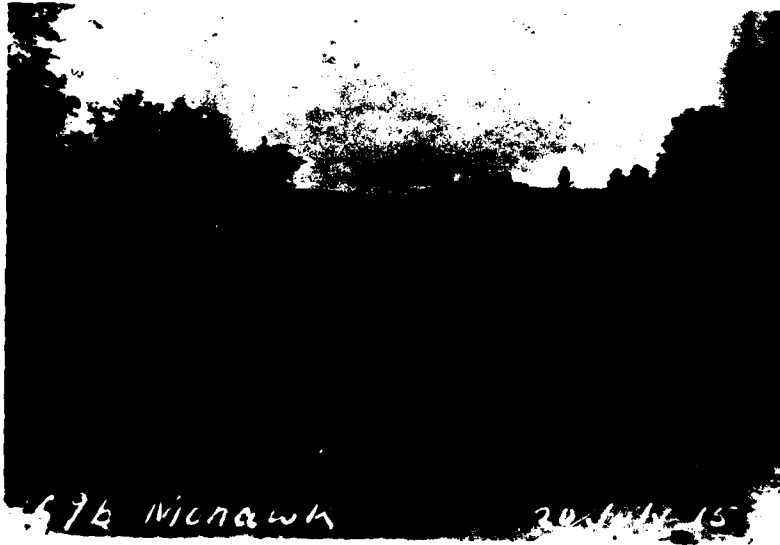
(In the space below, make one sketch showing the form and dimensions of a cross section through the spillway or waste-weir of this dam, and a second sketch showing the same information for a cross section through the other portion of the dam. Show particularly the greatest height of the dam above the stream bed, its thickness at the top, and thickness at the bottom, as nearly as you can learn.)



(In the space below, make a third sketch showing the general plan of the dam, and its approximate position in relation to buildings or other conspicuous objects in the vicinity.)

*Dam*



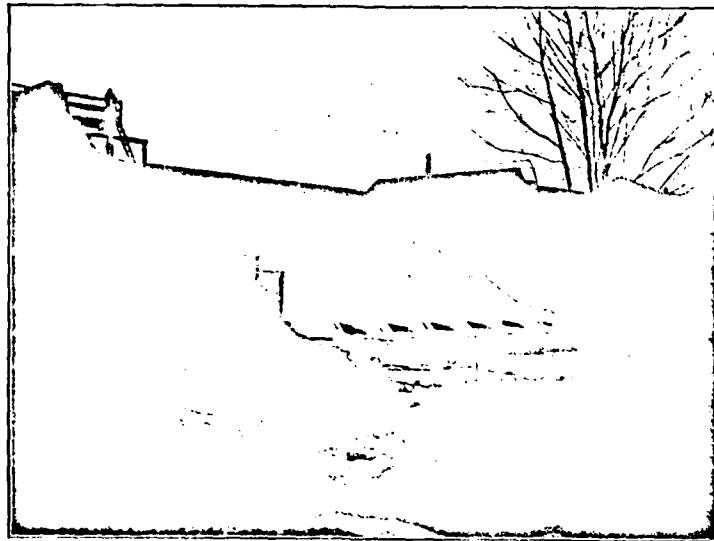


Overview Photo - Black Creek Reservoir Dam - 7/20/15

## THE GRAYS DAM.

At Grays, N. Y.

This dam was built in 1906 for the Consolidated Water Company of Utica, N.Y. It is of peculiar interest, as it was required to be built on a strict clay-sand foundation without gravel, hardpan or ledge. A further stipulation was that the dam should be carried to a present height of 30



THE GRAY'S DAM

Height, 30 feet; Length, including embankments, 400 feet.

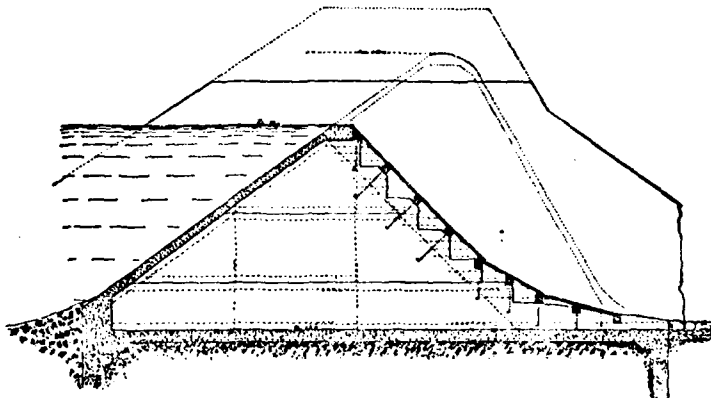
feet with provision for increasing the height to 40 feet, at the same time keeping the cost as near as possible in relative proportion to the height. The foundation was so soft as to show the print of a foot when the concrete floor was laid. The proportions are such that the distributed load due to the weight of a 40 foot dam and flood is 1.25 tons per square foot.

The means used for a future increase of height are shown in the sectional cut. The buttresses are carried up to the 30-foot grade and the

OWNER

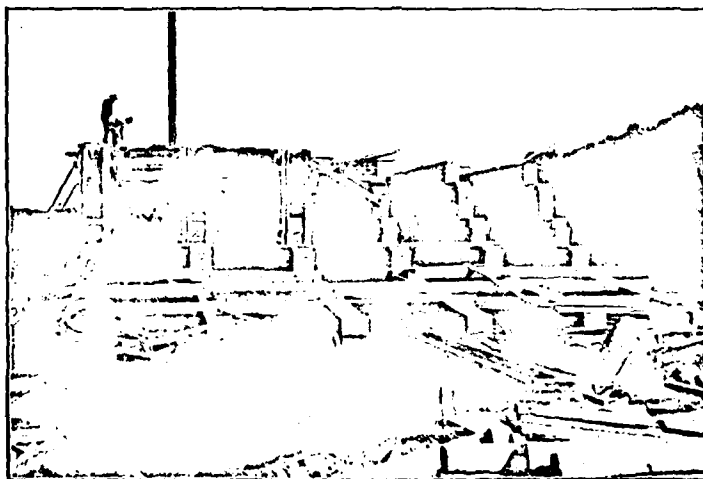
F3-42

front edge stepped off as shown, with corrugated rods left projecting from the edges. A temporary plank apron carries the water, logs and ice and protects the rods.



SECTION THROUGH ROLL-WAY  
Showing provision for raising.

Later on when the dam is to be raised the apron is removed, buttress forms set up and the dam carried up to its full height. The added section is self-stable without the rods but of course the rods bond the whole struc-



SHOWING STEPPED BUTTRESSES

OWNER

ture into a single monolith the same as if originally so constructed. The whole job is eminently successful and opens up a new possibility both in respect of foundations and in respect to increasing the height of the dam.

The dotted lines show the full height of the 40-foot rollway and bulkhead when completed.

Four of the bays contain an admirable arrangement of weirs whereby the discharge of the reservoir can be accurately measured.

This method of providing for increase of height in a dam is thoroughly practical. In the above dam it is rather crude in form, but has since been worked out much more carefully for structures of the first importance, as for instance, the Alamito dam in Texas which is made the subject of Leaflet (36).

THE AMBURSEN HYDRAULIC CONSTRUCTION CO.

OWNER

GRAY DAM, UTICA

BOARD OF WATER SUPPLY

WORKING PAPERS FOR ENGINEERING REPORT  
AND  
REPORT ON FIELD INSPECTIONS, ETC.

AMBURSEN ENGINEERING CORPORATION

OWNER

F3-45

AMBURSEN ENGINEERING CORPORATION

GRAY DAM, UTICA

ESTIMATE FOR COST OF RECONSTRUCTION

A - PREPARATION OF SITE

A-1	Access roads and working areas	\$ 1,200	
A-2	Clearing and stripping for embankments	1,850	
A-3	Cofferdamming and pumping	<u>2,500</u>	\$ 5,550

B - PREPARING PRESENT STRUCTURE FOR REPAIRS AND ADDITIONS

B-1	Remove wooden apron	\$ 350	
B-2	Remove damaged portions of deck	800	
B-3	Remove damaged portions of floor slab	650	
B-4	Trim existing buttresses for new bucket - 9 @ \$50	450	
B-5	Roughen and scour existing concrete surfaces - 9,320 sq.ft. @ 15¢	1,398	
B-6	Clean and straighten existing buttress dowels	700	
B-7	Cut drain holes in existing counterforts	300	
B-8	Drilling abutment walls for bars, anchorages and dowels	1,500	
B-9	Excavate for abutment additions - 1600 c.y. @ \$4	<u>6,400</u>	\$ 12,548

C - REPLACE AND REPAIR

C-1	Replace damaged portions of deck	\$ 2,000	
C-2	Replace damaged portions of floor slab	1,800	
C-3	Repair upstream abutment faces	<u>900</u>	\$ 4,700
Brought Forward			\$ 22,798

CLONER

Carried Forward \$ 22,798

D - NEW CONSTRUCTION - CONCRETE

D-1	Abutment footing extensions - 26 c.y. @ \$35	\$ 910	
D-2	Abutment counterforts - 89 c.y. @ \$50	4,450	
D-3	New entry stairwell - 72 c.y. @ \$75	5,400	
D-4	Abutment facings - 142 c.y. @ \$55	7,810	
D-5	Abutment wall extensions - 80 c.y. @ \$50	4,000	
D-6	Deck facing - 71 c.y. @ \$55	3,905	
D-7	Spillway buttress extensions - 376 c.y. @ \$50	18,800	
D-8	New deck - 62 c.y. @ \$60	3,720	
D-9	New bucket - 154 c.y. @ \$60	9,240	
D-10	New apron - 134 c.y. @ \$60	8,040	
D-11	New crest - 78 c.y. @ \$60	4,680	
D-12	Fill in old log sluice - 20 c.y. @ \$45	900	
D-13	New core wall - 247 c.y. @ \$50	<u>12,350</u>	\$ 84,205

E - REINFORCEMENT AND MISCELLANEOUS METALS

E-1	Steel reinforcing bars - 160,000 lbs. @ .135	\$21,600	
E-2	Steel dowels - 13,500 lbs. @ 15¢	2,025	
E-3	Handrailing - 96 lin.ft. @ \$8	768	
E-4	Flashboard posts and fittings	240	
E-5	Water stops	<u>120</u>	\$ 24,753
Brought Forward			\$131,756

CLONER

Carried Forward \$131,756

F - NEW CONSTRUCTION—MISCELLANEOUS

F-1	Flashboards	\$	450	
F-2	Hatch cover for stairwell		150	
F-3	Premolded joint filler		160	
F-4	Asphalt paint		270	
F-5	Epoxy paints and cements		<u>340</u>	\$ 1,370

G - EMBANKMENTS

G-1	Backfill abutments - 1600 c.y. @ \$3	\$	4,800	
G-2	Earth embankments, common - 9500 c.y. @ \$2.30		21,850	
G-3	Dumped rock, upstream slopes - 1350 c.y. @ \$5.50		7,425	
G-4	Dumped rock, cones - 1450 c.y. @ \$6		8,700	
G-5	Rockfill, hand placed - 200 c.y. @ \$7		1,400	
G-6	Topsoil and seed - 1,150 sq.yds. @ .60		<u>690</u>	\$ 44,865
GRAND TOTAL				\$177,991

OLIVER

MEMORANDUM TO THE FILES  
BY  
HOWARD F. McCAITER

August 26, 1963

INSPECTION OF GRAY DAM NEAR UTICA, N.Y.

On August 17, 1963 on my way to spend my vacation at camp on the Saint Lawrence River I stopped off at Gray Dam to recheck a couple of items on which there is quite a large difference in quantities in the estimate recently made here and the one made by Mr. Burroughs in 1948.

I looked over the embankments more carefully than I had done on July 16, 1963 and I am satisfied that the embankment quantities used in our latest estimate are as accurate as can be calculated from the information available. In estimating the embankment we had the benefit of information in the form of prints of the reservoir area with contours up to elevation 92. This information was not available for Mr. Burroughs' 1948 estimate. Due to the very heavy growth of brush and trees I can see how it would be possible to make a large error in quantities without the contour maps.

I observed the shoreline of the existing reservoir as best I could. It appears to be very heavily overgrown with bushes and trees right down to the water line. Using the map with contours up to elevation 92 and extrapolating up to elevation 103 we estimate that some 300 acres of additional land will be flooded by the 13 foot increase in pond level. As we do not know how much if any clearing is contemplated or necessary and as the cost of doing this work can vary over such a wide range we feel that attempting to include it in our new estimate might possibly unbalance the estimate so as to make it completely useless. In our opinion it will be better for us to omit this item as the Utica Water Board is probably in a better position to estimate its cost than we are. Moreover we are not sure that the Water Board wants to do this clearing at all.

OWNER

Memorandum to the Files

- 2 -

August 26, 1963

I also took another good look at the existing abutments and am satisfied that the proposed method of repair and raising will be as economical as can be devised to insure a safe stable condition.

H. F. McCARTER

CLOVER

F3-50

MEMORANDUM TO THE FILES

By  
HOWARD F. McCARTER

August 14, 1963

PROJECT:

City of Utica, N.Y. Water Supply Dam at Gray, N.Y.  
Raising dam and embankments 10 feet and installing  
3 foot high collapsible flashboards, making the  
total height increase 13 feet.

Dam was originally built by Ambursen around 1907  
with provisions for raising 10 feet.

REFERENCES :

Memo to Files by E. H. Burroughs dated November 19, 1948.

Letter to Mr. L. J. Griswold of the Utica Board of Water  
Supply dated January 5, 1949 by E. H. Burroughs.

Memo to Files by H. F. McCarter dated July 19, 1963.

Sketch 6302-A showing the General Arrangement of the  
raised Dam and Embankment

Sketch 6302-B showing the General Arrangement of the  
raised Abutments

Sketch 6302-C showing General Arrangement of Buttress  
Extensions, New Deck, Crest, Apron, Cucklet and Flash-  
boards.

Sketch 6302-D showing the General Arrangement of the  
Base Slab Extensions and new Counterforts at the dam  
Abutments.

Consolidated Water Co. Drawing No. 4 showing a cross  
section through the original dam.

Ambursen Drawing No. 6-30B showing a plan of the original  
dam.

OWNER

PREPARATORY WORK:

Cofferdam and Pumping: Unless it is possible to dewater the reservoir it will be necessary to cofferdam and pump a working area for repairing the upstream portions of the abutments and respining and facing the existing deck.

Clear and Strip: It will be necessary to clear all trees, brush and roots and to strip all top soil from the areas that will constitute the line of junction between the new embankment additions and the present embankment surfaces and ground surface. The zone around the perimeter of the existing reservoir that will be inundated by the increase in water height should eventually be cleared of trees and shrubs, but unless we receive special instructions it will not be included in our final cost estimate.

Remove Existing Wooden Apron:

Excavate Behind Existing Abutment Walls: In making the excavation for the base slab extensions and the new counterforts it will be necessary to provide bracing to counteract the resulting unequal soil pressure on the existing core wall.

ITEMS OF WORK:

The chronological order of the following items of work can, if desired, be used as a guide in setting up the order of work to be followed during construction. Of course many separate items of work will be carried on simultaneously.

DLOVER

Abutments:

- a) Drill existing walls and base slabs for dowels and reinforcing bars.
- b) Cut drain openings in old counterforts
- c) Repair faces of walls upstream of the existing deck.
- d) Build additions to base slabs.
- e) Build new wall facing. At this time the wall faces can be plumbed up- the east or left abutment wall has a very decided lean away from the embankment.
- f) Build new counterforts; the new stairwell will be built at the same time as the new counterforts for the west or right bank abutment.
- g) Build the additions to the tops of the existing abutments- a portion of the new core walls will be built integrally with the abutment wall additions. This cannot be done until Item (b) under "Embankments" has been completed.

Buttress Additions:

- a) Repair damaged floor concrete.
- b) Remove concrete at downstream ends of existing buttresses and rebuild to fit new concrete bucket.
- c) Roughen and treat the existing concrete in areas that will be in contact with new concrete.

OWNER

- d) Straighten and clean existing dowels.
- e) Build buttress extensions.

Deck, Crest, Apron and Bucket

- a) Remove damaged deck concrete.
- b) Roughen upstream face of existing deck.
- c) Fill in existing log sluice.
- d) Replace concrete removed under item (a) and place new concrete facing on upstream face of existing deck.
- e) Pour new deck.
- f) Pour new bucket.
- g) Pour new apron.
- h) Pour new crest.
- j) Place new flashboards.

Embankments:

- a) Fill behind abutment walls. This must not be done until the new deck, apron and bucket have been built.
- b) Build embankments to top of existing embankments.
- c) Build core wall extensions. Also see item (g) under "Abutments".
- d) Complete embankment additions.
- e) Top soil and seed.

H. F. McCARTER

OWNER

MEMORANDUM TO THE FILES

By  
HOWARD F. McCARTER

July 19, 1963

SUBJECT: Inspection of Gray Dam. Water supply dam for the  
City of Utica, N.Y.

DATE: July 16, 1963

PRESENT: L. J. Griswold, Principal Engineer - Utica Water Dept.  
Vincent Fletcher, Chairman - Utica Water Dept.  
H. F. McCarter, Chief Designing Engineer - Ambursen

LAST PREVIOUS INSPECTION

BY AMBURSEN November 16, 1948 by E. H. Burroughs- See memorandum to  
the files dated November 19, 1948

FEATURES OF DAM

1) Reservoir:

The reservoir had been drawn completely down so that there  
was only a trickle of water flowing through it.

From a conversation between Mr. Griswold and Mr. Fletcher I  
gathered that someone has made the claim that the reservoir capacity has been  
reduced substantially by silting. I believe that this is the principal reason  
for the aerial survey which will be made shortly. From the appearance of the  
reservoir I would say that practically no silting has taken place because you  
can see the entire stumps of trees that were cut to clear the reservoir when  
the dam was originally built.

There is a very heavy growth of evergreen trees right down to  
the present water line and, as a result, the cost of a relatively small amount

OWNER

of clearing and grubbing should be included in the estimate for raising the dam. It should be estimated high.

Mr. Griswold promised to send us a print of a contour map which, he says, covers the area around and adjacent to the reservoir. We will need this to lay out and estimate the cost of the embankment additions.

2) Embankments:

As reported in Mr. Burroughs' memo of Nov. 1948, the downstream embankment slope was never finished and is very steep (steeper than 1 on 1) and undoubtedly the fact that there has been no leaking or failure is due to the presence of very substantial core walls. The tops of these wall are visible for some distance from the dam at both ends and they appear to be in nearly perfect condition.

At the abutment end of both upstream embankments there are substantial dumped rock cones. These are in line with what we will recommend for the raised embankments.

I showed Mr. Griswold the sketch I prepared last winter which shows the upstream embankment slopes built up to 1 on 1.6 by means of a dumped rock fill and the downstream slopes built up to 1 on 2.5 by means of earth fill with wrap-around rock cones at the abutments. He offered no objections to this arrangement.

Because of long past experience with this dam, Mr. Griswold does not think that any additional freeboard will be required because of the 3 foot collapsible flashboards. (We will therefore show the abutments and embankments raised ten feet rather than thirteen feet as shown on last winter's sketches.)

*13' needed,*

OWNER

3) Abutment Buttresses:

The condition of these structures is still much the same as reported in Mr. Burroughs' memorandum, and there is no evidence of any repairs having been made. However the left abutment is no longer standing in perfect perpendicular alignment; its downstream portion has further separated from the counterforts and there is a definitely discernible tilt away from the embankment. The right abutment is still, to all appearances, standing in a vertical position. Otherwise, except for the rock pockets mentioned by Mr. Burroughs, the abutment buttresses appear to be in excellent condition.

Probably the main reason that only the downstream portions of the abutment walls have tended to separate from the counterforts is the bracing action provided by the concrete deck which is continuous, without joints, clear across the dam from abutment to abutment.

I discussed various methods of raising and reinforcing these structures with Mr. Griswold and we both agree that nothing definite can be decided until the adjacent embankments have been removed and the back faces of the abutment walls exposed for inspection. I told him that we might show alternate arrangements in the drawings which we are to prepare, and that the final details would be made after inspection of the rear faces. He appeared to feel that such an arrangement would be satisfactory. I have several different ideas in mind and may discuss them in a later memorandum.

4) Deck:

The deck is still much as described in Mr. Burroughs' old memorandum. However I doubt that the zones of relatively poor concrete extend anywhere near all the way through the concrete. I base this opinion on the

DOVER

statements of Mr. Griswold and the caretaker of the dam who has been there for many years. I believe the job has been in care of the same family ever since the dam was built. They both say that the deck has never been known to leak a drop, which would indicate that the inner and bottom zones of concrete must be in pretty good shape. Mr. Griswold and I both agree that about all that need be done is to remove the loose and damaged concrete, roughen the entire deck, apply modern treatment to the treated deck, and install a new concrete facing, heavily reinforced, and with ample additional bars to take negative bending over the buttresses.

5) Floors:

The floor remains as described by Mr. Burroughs. I believe that all that need be done is to remove carefully and replace any damaged concrete. However, drilling and thorough inspection must be made over that area.

6) Spillway Buttresses:

The spillway buttresses, at least those portions well within the dam, are in surprisingly good condition and it may not be necessary to face them as shown on the sketches I made last winter. Their extreme downstream portions, especially on the buttresses adjacent to the outlet bays, are badly eroded, by frost action and running water. This will be costly, as most if not all of this concrete may have to be removed anyway to make room for the new concrete bucket.

7) Outlet Works:

As described by Mr. Burroughs, there are four valve-controlled outlet pipes, one in each of four bays. Mr. Griswold says that no changes

CLOVER

are contemplated in this arrangement and therefore we will not be required to concern ourselves with this feature. As a matter of record, the wooden weirs shown on the original drawings have completely disintegrated, and under the present operating procedure they are no longer required.

8) Apron:

The wooden apron was replaced a couple of years ago and is in excellent condition. This is only the second time it has been replaced since the dam was built in 1906 or 1907! It will be removed in the contemplated reconstruction.

9) Log Sluice:

The notch in the deck which was provided for a log sluice will be closed as there is no longer any need for a log sluice here. In Mr. Burroughs' memorandum he says that the log sluice was never used.

10) Entrance:

Entrance to the inside of the dam is by means of a trap door in the apron, the old entrance through the right abutment having been filled in and closed. *no (Rebuild)* Mr. Griswold and the caretaker are both very much in favor of a new stair well to the old opening. We will work this out and show it on our drawings.

11) Walkway Through the Dam:

The walkway is built of timber and is in excellent condition. A .2 x 4 handrailing should be added.

PHOTOGRAPHS I shot a roll of 35 mm black and white (20 exposure) but do not have the prints as of this writing.

CLONER

H. F. McCARTER

REPORT FROM GEORGE WOHLER

August 2, 1963

Ambursen Engineering Corp.  
295 Madison Avenue  
New York, N.Y.

Atten: Mr. S. W. Stewart, Pres.

Dear Mr. Stewart:

In reply to your letter of July 30, 1963 in regards to "Gray Dam".

I have just returned from a visit to the Dam and the following are some of my observations:

1. There is a good access road, which looks as if it had been built recently, at the northwest end of the dam. This road leads to the hearth; the road is gravel, and has considerable room on either side for storage and equipment, and there is also a large space at the junction of the main highway where crushed stone and sand has been stored by the County, and which I understand they do not use any more.

With very little work with a bulldozer any one could fix this road so that one would be able to drive a crane out onto the hearth which projects quite some distance from the end of the spillway. I believe that a crane setting on the hearth could reach nearly all of the work contemplated on the dam except perhaps the addition on the abutments, which would probably require lengthening the boom.

The wooden spillway, which is made of 4" hardwood plank, and nailed to wood timbers with iron dowels or very large spikes would warrant a crane for their removal, also the handling of sectional forms for buttresses, and placing of concrete, and stripping of the forms could be done by crane. I think a small portable mixer could be set up within reach of the crane.

OWNER

The old road on the south east end of the dam is in very poor condition, and quite steep in places. It tops the embankment about 40' from the southeast abutment. Directly south of this point the ground rises and levels off, I think quite suitable for a cableway tower. However the room on top of this embankment is small, unless one goes out toward the reservoir basin. Looking across the dam the northwest side looks as if it slopes down, but I think it would be suitable for cableway tower; there is so much brush and trees that it is hard to tell how the land lays.

There was also a road leading to the top of the northwest embankment, but it is all grown up with trees and brush, and I was unable to find the alignment.

Most of the people that live in these small towns around Utica, Herkimer and Ilion all work in the city. Labor will be difficult. The question of Unions must be handled carefully.

If Mr. McCarter is up in this section again I would be glad to have him come and see me, to talk Ambursen dam. Since Mr. Baland left I have not heard much about Ambursen Dam men, I guess most of the old timers have passed on. We generally get a Christmas card from Mr. Huntley. You mentioned that Ed Burroughs is living in New Hampshire. Did he fully recover from the illness he had?

I hope what little information I have given will be of some use to you.

If there is anything further that I can do from this end, I will be glad to do it.

Yours truly,

/s/ Geo. K. Wohler

OWNER

MEMORANDUM TO THE FILE:

By  
E. H. BURROUGHS

November 19, 1948

INSPECTION OF UPPER GRAY, N.Y.  
WATER SUPPLY DAM  
CITY OF UTICA

On November 16th I arrived in Utica and called at the office of the Board of Water Supply at 712 Washington Street where I met Mr. L. J. Griswold, principal engineer for the Board. I also met his assistant, Mr. Roesser.

We at once set out for the dam which is about 25 miles out of Utica on a good black top surface road. The dam is located on Black Creek only a short distance out of the small town of Gray on the road to Little Falls, N.Y.

As our records will show, this dam was built for a private company named the Consolidated Water Company of Utica, and was built in 1906-7. The construction was done by our company.

The city of Utica took over the dam some years ago having purchased all property and rights from the private company.

Through a contract agreement with the owners of a large water supply dam some distance below the Upper Gray Dam the city of Utica draws its present water supply from that reservoir. It was constructed and is now controlled by two or three power companies and one or two paper companies. The tributary, Black Creek, flows into this main reservoir. The City has two low dam sites on the same watershed from which it could feed water into this main reservoir. However, it appears that the most economical means of supplying additional storage is by means of raising the old Upper Gray Dam.

The Upper Gray Dam now supplies a storage of about one billion cubic feet of water which will be doubled by increasing the height of the dam the

*POWER*

proposed amount, namely 10'. However, any additional height that the dam could be raised, say 3' or 4' should be studied as Mr. Griswold said that he was sure the small cost of additional flowage rights would be justified and would greatly increase the amount of added storage. We are to see how much the present structure can be safely raised.

Before investigating the site I brought up the possibility of installing crest gates or Tainter gates for the purpose of storing water to flood level but this is quite evidently out of the question because of the severe cold weather conditions and because it would require a caretaker and heating apparatus to keep the gates clear. Furthermore, it looks as though they would be prohibitive in cost in any event.

There is an unusual condition, that at any time the owners of the main reservoir call for dumping any or all of the water in the Upper Gray dam this has to be done. The reservoir was actually emptied two weeks ago and there was very little water in the reservoir bed which made it convenient for complete inspection of the structure.

Unfortunately we do not have a complete set of working drawings for this structure. One of the vital drawings is missing, namely the one showing reinforcement details. Our drawings show quite clearly the thicknesses of the various members and that is about all.

Our working drawing #6-30A essentially is correct except that the spillway crest at the right bank was not constructed as indicated but was built to include a log sluice entrance in the second bay from the right abutment. This is shown on the revised drawing which corrected date is given as October 18, 1906 which I have obtained from the City. Also, there is a step in the floor slab between buttress #3 and buttress #4 as indicated in this print and which is not shown on our print.

OWVER

In general, this structure is not one of our smoothest jobs of construction, although it should be remembered that the dam is over forty years of age. Nevertheless all parts with the exception of one deck described later are composed of substantial concrete. I see no reason why the structure cannot be raised at least to the proposed 10' height and probably a few feet higher.

It is more than likely that the concrete was made up of bank gravel obtained in the immediate vicinity of the dam. However, I do not think there is any evidence of deterioration due to dirty aggregate. Such imperfections as there are in the structure seem to be the result of rock pockets and lack of spading as well as the effect of overwet concrete, a common practice in those years.

Certainly very little effort was made in finishing up the earth embankments. Actually the embankments were not especially well constructed and if it was not for the fact that they contained a concrete corewall, they might have given trouble from leakage. There seems to have been placed the proper amount of material upstream from the corewall but on the downstream side the slopes were made very steep and irregular, with the result that the top sections of the counterforts of the two abutments are exposed, the designs for which conform with the outline of a proper earth embankment slope. In this connection I noticed that at least one counterfort on each abutment near the crest had fallen away from the abutment. Also, there appeared to be no reinforcing rods that should have tied the counterfort to the abutment. There is some question in my mind as to whether any of these counterforts were reinforced although one of the drawings indicates that a floor type of counterfort was used. Nevertheless, it is quite likely that both abutments may have

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been constructed merely as mass concrete walls without reinforcement and without any floor base on the earth-filled side. Nevertheless both abutments are standing in perpendicular alignment and there is no indication that there has been any movement of either abutment.

The left abutment, which is the east abutment, has a rock pocket at the downstream end on the water side. There is also some evidence of ice action, but the defect is not serious and can be readily corrected although considerable doweling will have to be done. There is also a similar condition on the right abutment but less serious.

The poorest spot of concrete is located on two decks adjacent to the left abutment about half way down the height of the dam. I am practically certain it was merely the result of a bad rock pocket. I did not get a chance to get down to this deck. In all probability this defect goes nearly all the way through the deck and I would expect that part of these two deck slabs will have to be replaced with new concrete. Unfortunately it was impossible to examine the underside of these two slabs because there is a buttress wall bracing the left abutment which extends vertically from the floor slab to the crest and includes two bays of the dam. Similar construction is located at the right abutment. Evidently these two strut walls were installed to help support the abutments and may contain tension steel.

The timber apron has been replaced at least once. However, it is in fair condition except that there are considerable openings between each timber and therefore it offers no protection against freezing inside of the dam.

I was told by the caretaker, a Mr. Farr who lives immediately below the dam,

OWNER

that the temperature never got below freezing inside the dam when water was running over it but that unless water was passing over the dam, it got down below freezing inside the dam. As a result they have had a little trouble with at least one of the valves. One or two new bonnets had to be installed because of freezing up of the valves.

The dam contains 24" outlets in four bays. However, if I recall correctly in only three bays were valves provided. These were 24" size. Our early drawing indicates that there is only one valve per bay but two were installed in each bay, one for emergency. The downstream valve was installed without a support (contrary to details of the drawing) and is supported by cantilever action of the pipe, a rather bad situation. In the raising of the structure this should be corrected.

The inspection of the inside of the dam revealed that all of the deck slabs examined appear perfectly sound. There is no indication of leakage nor is there any indication of cracks in the deck or in the buttresses. This dam was built with buttresses with 10' centers and no haunches, a type of construction long since abandoned, and it is surprising that some leakage did not occur at the deck supports.

The surface of the floor shows evidence of frost action as the skin surface has become badly roughened and the aggregate is showing but actually I would say the slab itself has not weakened any appreciable amount.

The reinforcing bars sticking out of the steps of the buttress for future extension are somewhat corroded but have not been rusted to the point of becoming useless. More and heavier dowels should have been used.

OWNER

The downstream step of the buttresses is shown considerably longer than indicated in our prints and, as will be seen from the photograph, is badly worn away. These steps will have to be removed entirely for the new buttress foundation extension.

There will be no occasion, in raising the dam, to provide a log sluice. In fact the log opening was installed but no log sluice was ever built.

There appears to be plenty of material for the raising of the embankments. The material contains quite a lot of gravel. The same type of core construction should be used.

It would be necessary to bring in aggregate for concrete. For the amount of concrete that will be required which will be less than 2000 yards, crushed stone should be purchased from the Easton Rock Products Company which has a large limestone quarry which I think is about 15 miles from the site. This same company will also furnish washed sand from its Trenton, N.Y., plant which I believe is 10 or 12 miles away. In returning from the site we called at the office of the Easton Rock Products Company but were unable to get any cost data because a girl was the only one present at the office. She said that we should write to their Utica office, attention Mr. C. A. Munce.

In the raising of the structure it seems highly desirable that a new means be provided for entrance to the inside of the dam. The original scheme was to enter through about a 4' square shaft on the right abutment. Two rows of narrow hand rungs were installed in the conventional manner. However, this was a tiresome means for frequent entrance. Furthermore, these rungs have now rusted nearly off in places and are dangerous for use. Entrance is now being

OWNER

made through a hole in the timber apron. Mr. Griswold thought that we should provide a horizontal concrete entrance conduit to be constructed on the water side of the right abutment, at about the level of the platform to the valves. Incidentally, no concrete platform was ever built inside the dam. Timber construction was used and this is in bad shape.

It would be quite costly to build a similar entrance on the earth side of the right abutment and I rather think that the new entrance should be built about as Mr. Griswold has suggested even though it will mean cutting down slightly the length of spillway.

This project looks like it might be about a \$125,000 or \$150,000 job of construction. I doubt that the cost of a cableway installation would be justified, but the cost estimate should clear that up.

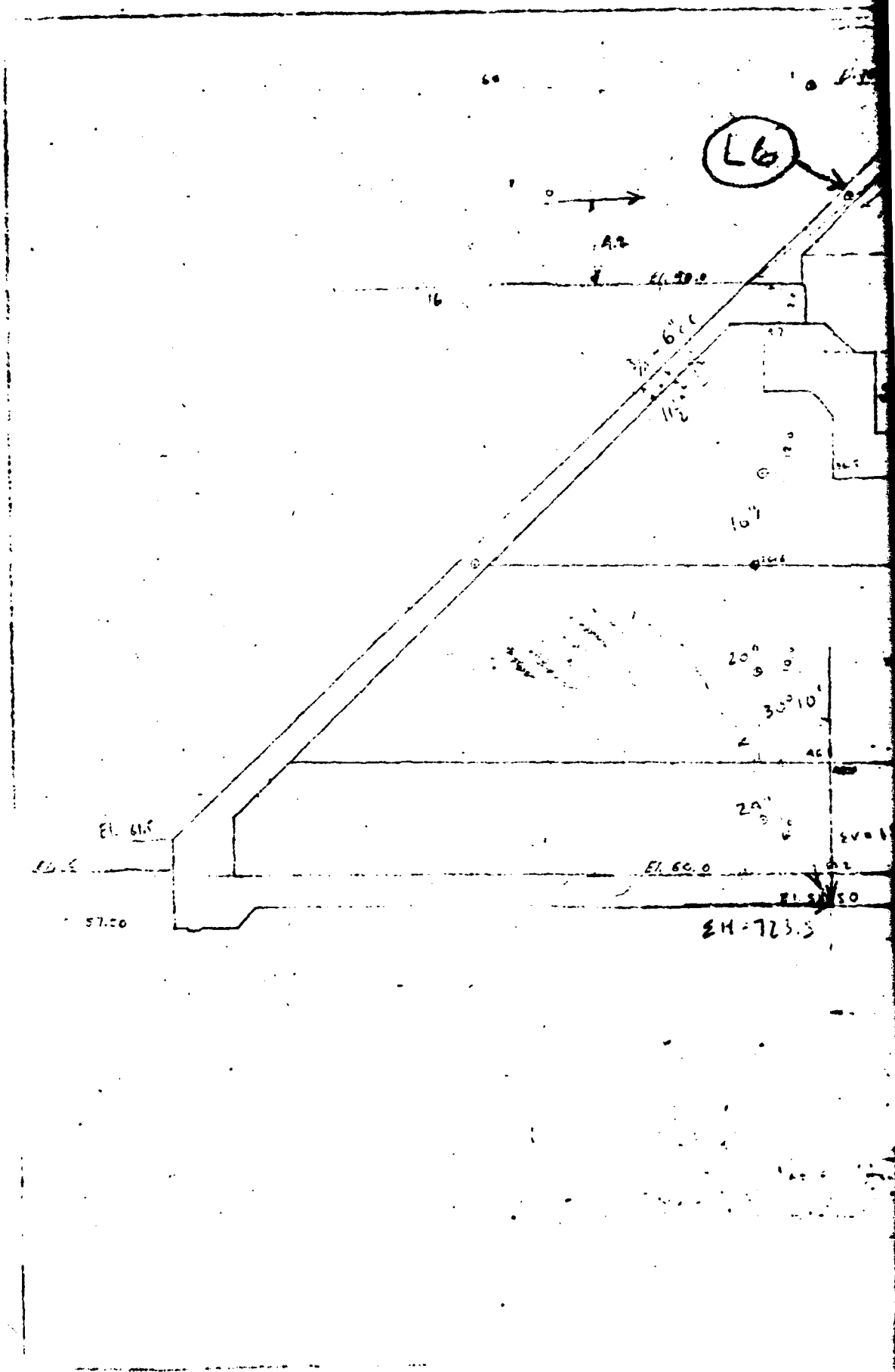
Labor is good in that area except that Utica and other nearby cities draw the best men to building work. I was informed that common labor in this area is getting about \$1.20 per hour and the carpenters and mechanics about \$1.80. It might pay to take a look at the idea of raising the rates so as to pull in the best men. It will not be a long job if we can get full cooperation all around.

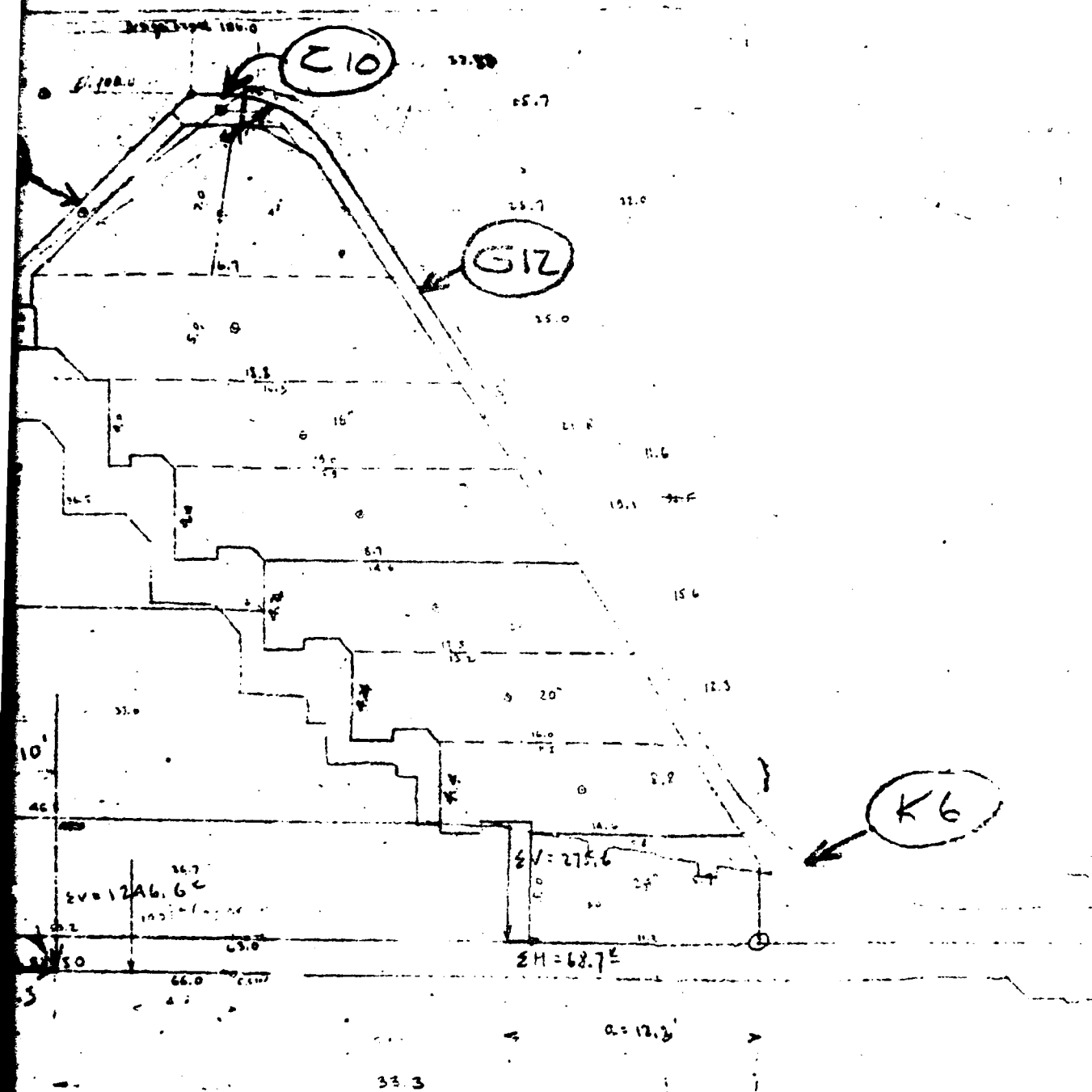
I have not checked the Union situation as I think it would be premature and unwise to do so now.

E. H. BURROUGHS

EHB:JP

DLONER

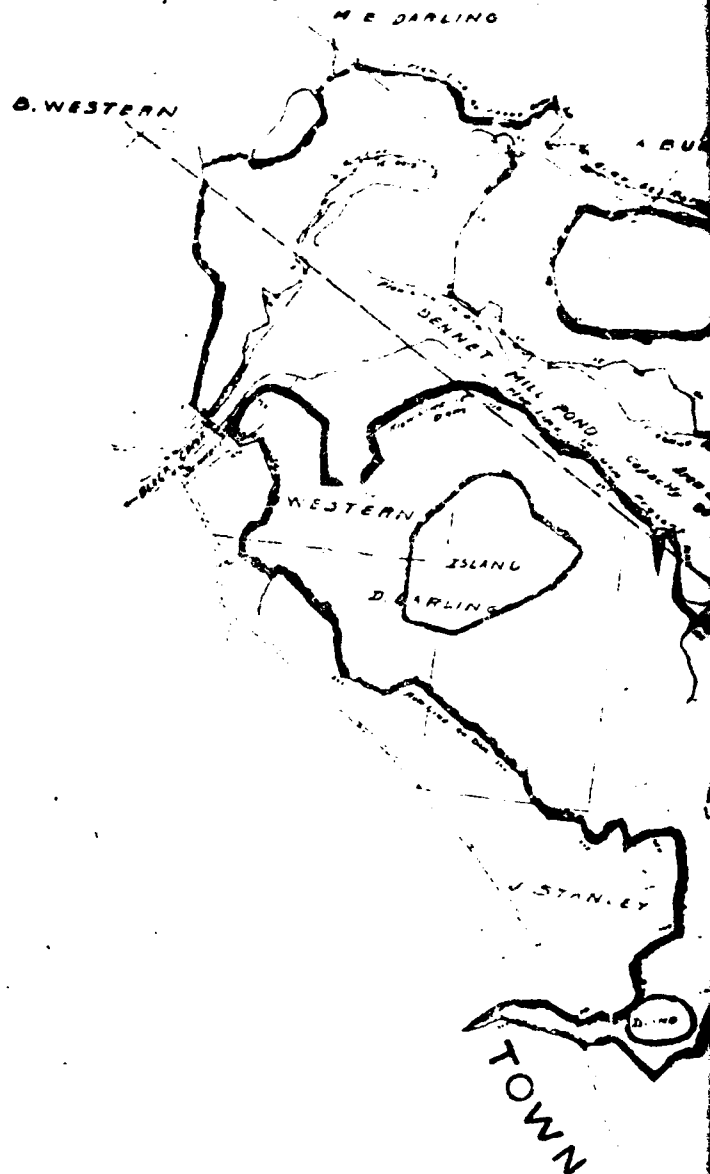




Gang Dam  
 Scale:  $\frac{1"}{4} = 1-0'$

Stability Investigation  
 S.T. 12-1-45

FOR ESTIMATE ONLY  
 NOT FOR CONSTRUCTION



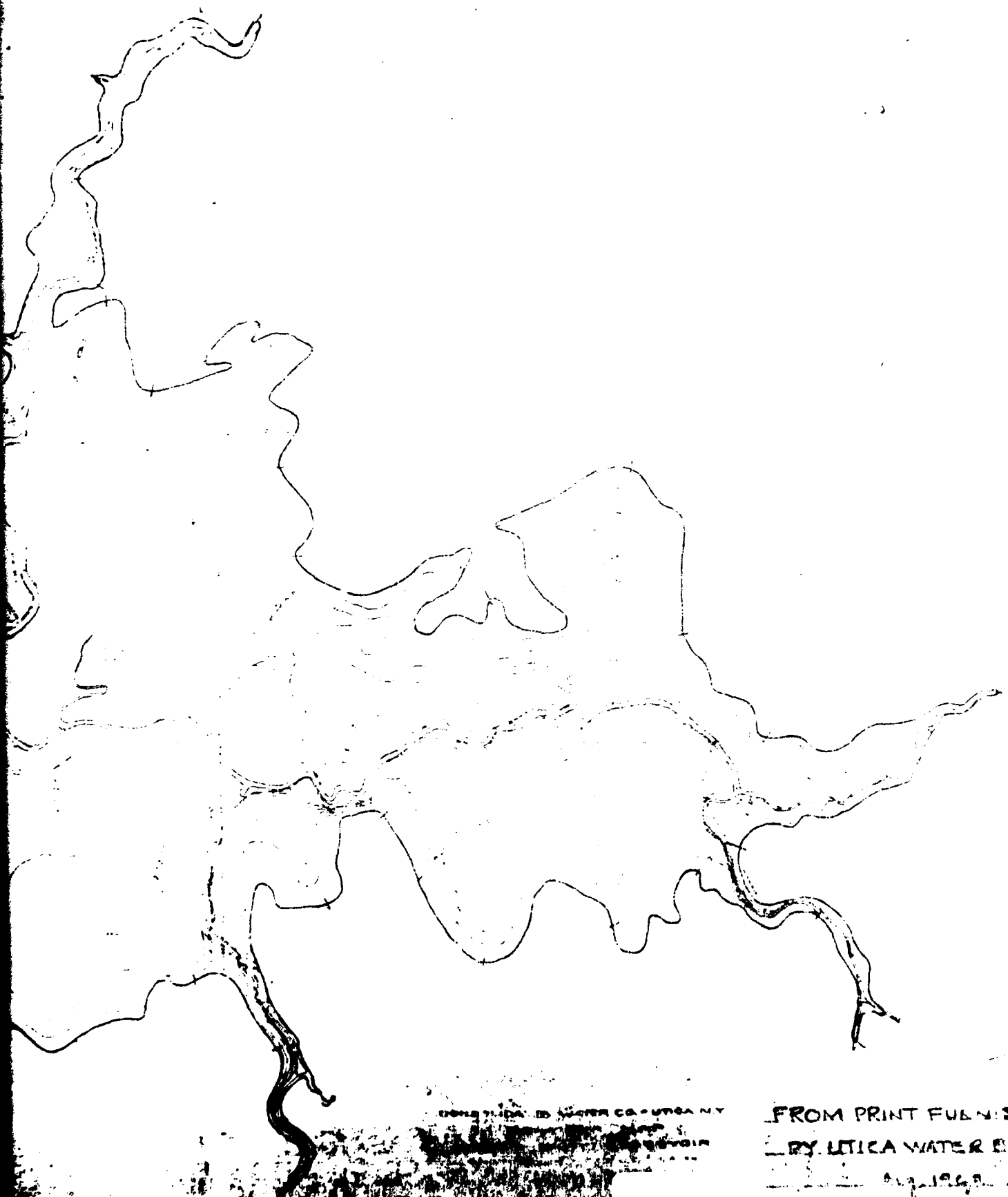
# NOTE

Area	Old Pond	551 Acres
Capacity	50000000	Galls
	12 000 000	Ca ft
Area	15 ft. Dam	117 Acres
Capacity	230 434 750	Galls.
	30 731 300	Ca ft.
Area	40	623 Acres
Capacity	3 252 159 750	Galls.
	431 667 300	Ca ft.
Area	20-6	5 859 Acres
Capacity	583 249 637	Galls
	75 233 805	Ca ft.

PRESENT DAM 10 FT HIGH  
 HEIGHTS OF OTHER DAMS  
 RECKONED FROM BOTTOM  
 OF PRESENT DAM







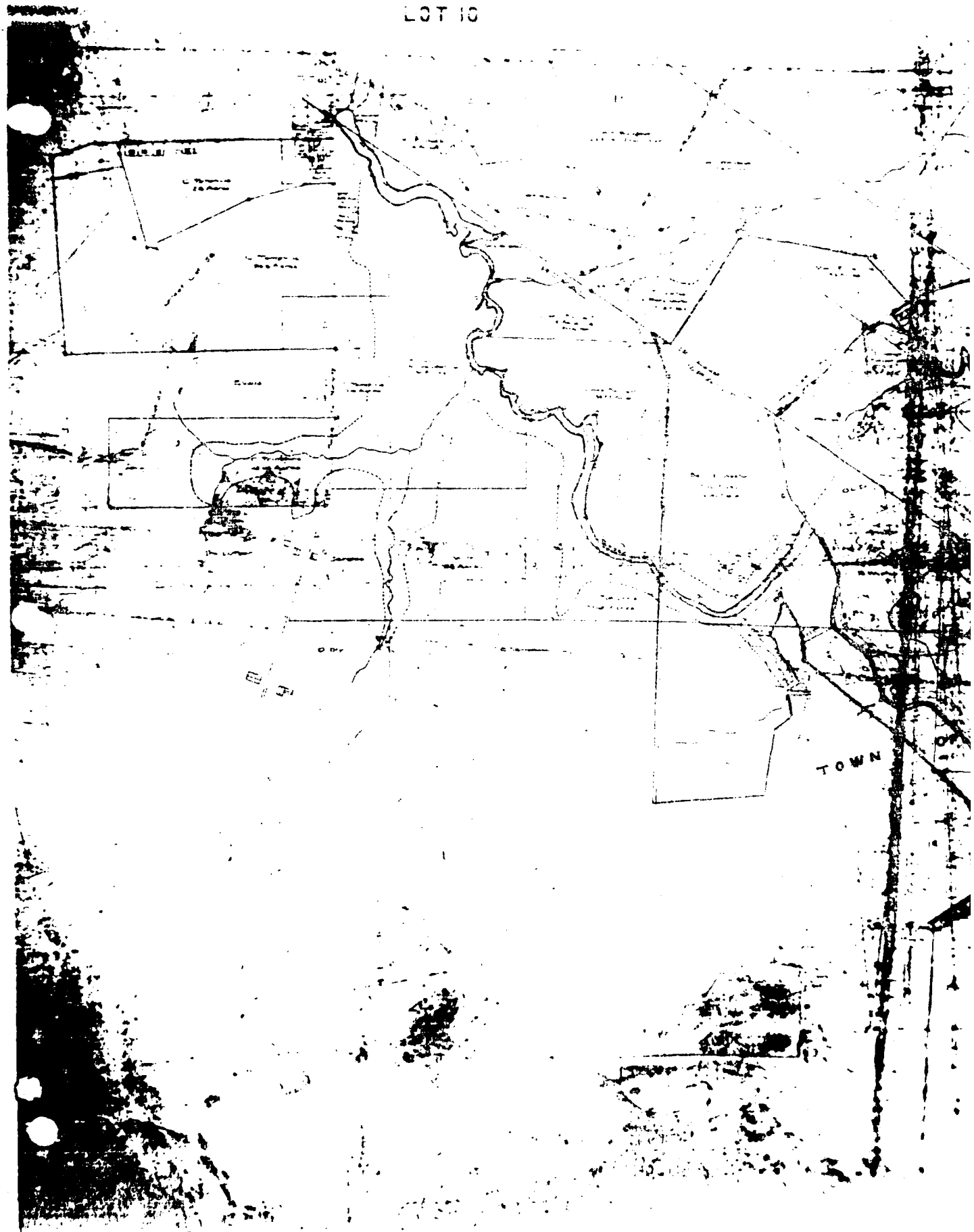
ENGINEERED BY JACOB CO. - UTICA, N.Y.

FROM PRINT FURNISHED  
BY UTICA WATER BOARD

AUG. 1948

F 3-71

LOT 10



AD-A109 970

7/6 1971  
MALE (C T) ASSOCIATES SCHENECTADY NY  
NATIONAL DAM INSPECTION PROGRAM. BLACK CREEK RESERVOIR DAM (NY --ETC(U)  
SEP 81 K J MALE  
DACW51-81-C-0014  
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3 of 3

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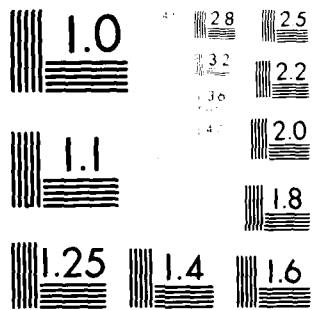
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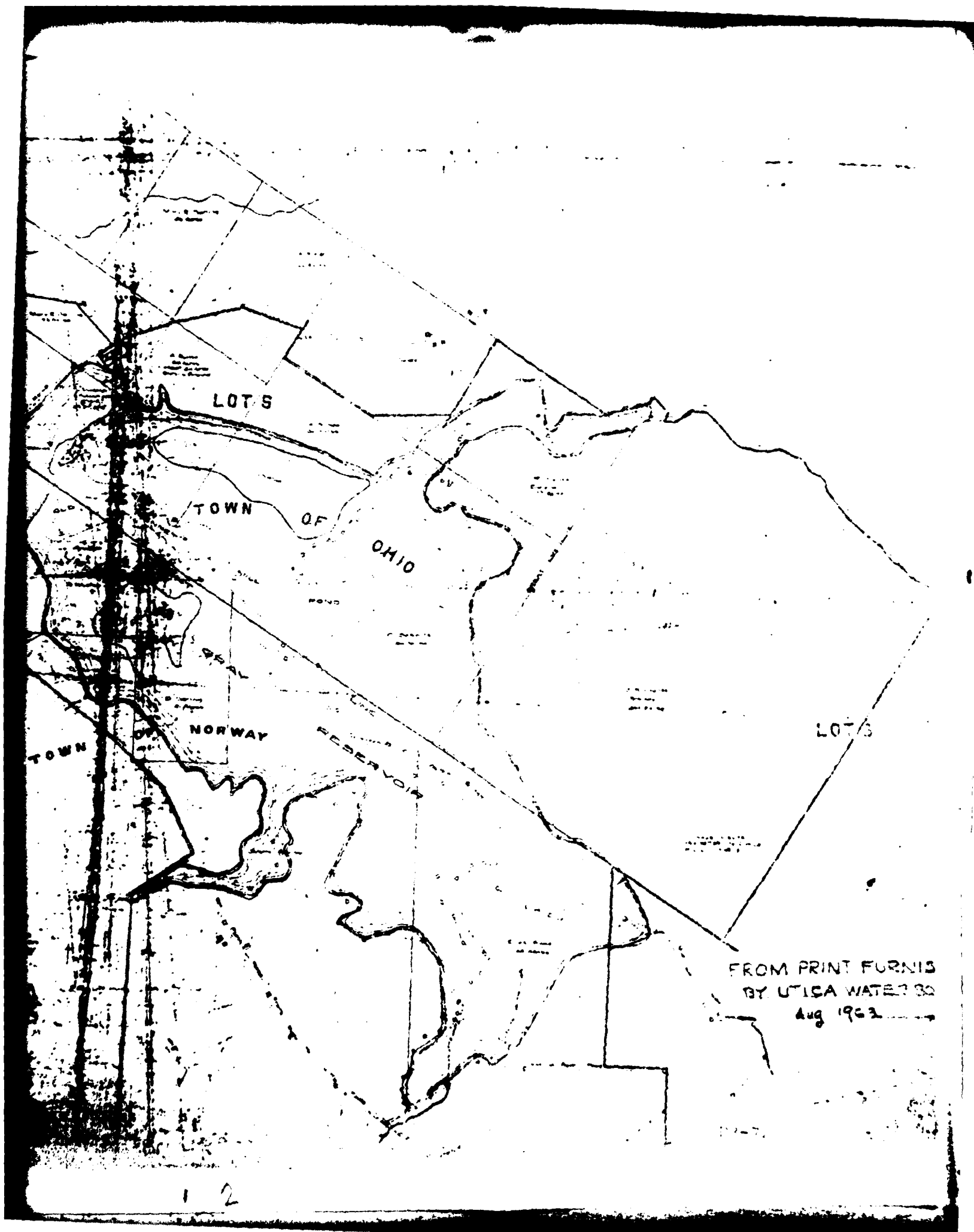
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03-82

DTIC



MICROCOPY RESOLUTION TEST CHART  
NATIONAL BUREAU OF STANDARDS-1963-A



15] The following items have been omitted from the copy of the report titled "Working Papers for Engineering Report and Report on Field Inspections, Etc." included as Appendices F3-45 to F3-72:

- 1) 4 pages of photos taken July 1963.
- 2) Sketch with embankment volume calculations.
- 3) Sketch showing general arrangement of the proposed raised spillway and embankment in cross-section.
- 4) Sketch showing general arrangement of the proposed raised spillway and embankment in plan.
- 5) Sketch with rock volume calculations.
- 6) Sketch with cross-sections of proposed raised embankment.
- 7) Sketch with proposed new counterforts.
- 8) Sketch with proposed new spillway deck.
- 9) Plan of Spillway, by Ambursen Hydraulic Construction Co. - see Appendix G-2.
- 10) Spillway Section and Details, traced by Consolidated Water Company of Utica - see Appendix G-3.

# DAI DAM INSPECTION REPORT

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NO.	CITY	YE AP.	DAM NO.	INS. DATE	USP	TYPE

<input type="checkbox"/> Location of Sp'way and outlet	<input type="checkbox"/> Elevations
<input type="checkbox"/> Size of Sp'way and Outlet	<input type="checkbox"/> Geometry of Non-overflow section

<input type="checkbox"/> GENERAL CONDITION OF NON-OVERFLOW SECTION		
<input type="checkbox"/> Settlement	<input type="checkbox"/> Cracks	<input type="checkbox"/> Deflections
<input type="checkbox"/> Joints	<input type="checkbox"/> Surface of Concrete	<input type="checkbox"/> Leakage
<input type="checkbox"/> Undermining	<input type="checkbox"/> Settlement of Embankment	<input type="checkbox"/> Crest of Dam
<input type="checkbox"/> Downstream Slope	<input type="checkbox"/> Upstream Slope	<input type="checkbox"/> Toe of Slope

<input type="checkbox"/> GENERAL COND. OF SP'WAY AND OUTLET STRUCT.		
<input type="checkbox"/> Auxiliary Spillway	<input type="checkbox"/> Service or Concrete Sp'way	<input type="checkbox"/> Killing Basin
<input type="checkbox"/> Joints	<input type="checkbox"/> Surface of Concrete	<input type="checkbox"/> Spillway Toe
<input type="checkbox"/> Mechanical Equipment	<input type="checkbox"/> Plunge Pool	<input type="checkbox"/> Drain

<input type="checkbox"/> Maintenance	<input type="checkbox"/> Hazard Class
<input type="checkbox"/> Evaluation	<input type="checkbox"/> Inspector

## COMMENTS:

GUNITE USED 1967  
 CONCRETE SHOWING SIGNS OF WEAR, RE-RO.  
 EXPOSED IN VARIOUS PLACES.

DEC

## DEC DAM INSPECTION REPORT CODING

1. Plate Page - Nos. 1-23 on Compilation Sheets
2. Cont. - Nos. 1-62 Alphabetically
3. Year Inspected -
4. Inspection Date - Month, Day, Year
5. Approved Use
  1. Fish & Wildlife Management
  2. Recreation
  3. Water Supply
  4. Power
  5. Farm
  6. No Apparent Use
6. Type
  1. Earth with Aux. Service Spillway
  2. Earth with Single Conc. Spillway
  3. Earth with Single non-conc. Spillway
  4. Concrete
  5. Other
7. As-Built Inspection - Built substantially according to approved plans and specifications

### Location of Spillway and Outlet Works

1. Appears to meet originally approved plans and specifications.
2. Not built according to plans and specifications and location appears to be detrimental to structure.
3. Not built according to plans and specifications but location does not appear to be detrimental to structure.

### Elevations

1. Generally in accordance to approved plans and specifications as determined from visual inspection and use of hand level.
2. Not built according to plans and specifications and elevation changes appear to be detrimental to structure.
3. Not built according to plans and specifications but elevation changes do not appear to be detrimental to structure.

### Size of Spillways and Outlet Works

1. Appears to meet originally approved plans and specifications as determined by field measurements using tape measure.
2. Not built according to plans and specifications and changes appear detrimental to structure.
3. Not built according to plans and specifications but changes do not appear detrimental to structure.

### Geometry of Non-overflow Structures

1. Generally in accordance to originally approved plans and specifications as determined from visual inspection and use of hand level and tape measure.
2. Not built according to plans and specifications and changes appear detrimental to structure.
3. Not built according to plans and specifications but changes do not appear detrimental to structure.

### General Conditions of Non-Overflow Section

1. Adequate - No apparent repairs needed or minor repairs which can be covered by periodic maintenance.
2. Inadequate - Items in need of major repair.

(Check) For boxes listed on condition under non-overflow section.

1. Satisfactory.
2. Can be covered by periodic maintenance.
3. Unsatisfactory - Above and beyond normal maintenance.

## DEC DAM INSPECTION REPORT CODING (cont.)

### General Condition of Spillway and Outlet Works

1. Adequate - No apparent repair needed or minor repairs which can be covered by periodic maintenance.
2. Inadequate - Items in need of major repair.

(Items) For items listed conditions listed under spillway and outlet works.

1. Satisfactory.
2. Can be covered by periodic maintenance.
3. Unsatisfactory - major and beyond normal maintenance.
4. Dam does not contain this feature.

### Maintenance

1. Evidence of periodic maintenance being performed.
2. No evidence of periodic maintenance.
3. No longer a dam or dam no longer in use.

.5.)

### Damage Classification Summary

1. (A) Damage to agriculture and country roads.
2. (B) Damage to private and/or public property.
3. (C) Loss of life and/or property.

Evaluation - based on Judgment and Classification in Dec Dec.

### Evaluation for Specific Dam

1. Good - Satisfactory.
2. Good - Not Satisfactory.
3. Unsatisfactory - evidence of decay or damage.

Item	Condition	Remarks
(1) LOWER MUDGON	1	100% Satisfactory
(2) UPPER MUDGON	2	100% Satisfactory
(3) RICHMOND	3	100% Satisfactory
(4) LAKE CHOCOMA	4	100% Satisfactory
(5) DELACORTE	5	100% Satisfactory
(6) SHINGO	6	100% Satisfactory
(7) CHENING	7	100% Satisfactory
(8) CHENING	8	100% Satisfactory
(9) CHENING	9	100% Satisfactory
(10) ALLEGHENY	10	100% Satisfactory
(11) LAKE ERIE	11	100% Satisfactory
(12) WESTERN LAKE ERIE	12	100% Satisfactory
(13) CENTRAL LAKE ERIE	13	100% Satisfactory
(14) EASTERN LAKE ERIE	14	100% Satisfactory
(15) SARONN RIVER	15	100% Satisfactory
(16) BEAR RIVER	16	100% Satisfactory
(17) WEST ST. LAWRENCE	17	100% Satisfactory
(18) EAST ST. LAWRENCE	18	100% Satisfactory
(19) LAKE ERIE RIVER	19	100% Satisfactory
(20) ST. LAWRENCE RIVER	20	100% Satisfactory
(21) MISSISSIPPI	21	100% Satisfactory
(22) MISSISSIPPI	22	100% Satisfactory
(23) MISSISSIPPI	23	100% Satisfactory
(24) MISSISSIPPI	24	100% Satisfactory
(25) MISSISSIPPI	25	100% Satisfactory
(26) MISSISSIPPI	26	100% Satisfactory
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(30) MISSISSIPPI	30	100% Satisfactory
(31) MISSISSIPPI	31	100% Satisfactory
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(97) MISSISSIPPI	97	100% Satisfactory
(98) MISSISSIPPI	98	100% Satisfactory
(99) MISSISSIPPI	99	100% Satisfactory
(100) MISSISSIPPI	100	100% Satisfactory

DEC



Spillway from left retaining wall - 9/14/71



Exposed reinforcement and deteriorated concrete at bottom of left retaining wall of spillway - 9/14/71

**GRAY RESERVOIR CAPACITIES**  
**PREPARED FOR**  
**CITY OF UTICA BOARD OF WATER SUPPLY**  
**1975**



WATER

PS-78

**Donnerstag + Freitag**

Notes from for heads of computations contained in this report was obtained from a topographic map of Mount  
Creek Reservoir made for the City of Tulsa under of Water Supply by geodetic-surveying methods from  
conducted by Fairchild's Aerial Surveys dated July 24, 1941.

**THE FIVE YEAR COMBAT**

Customer Name.	A	B	Cu. Ft.	Acum. Total Cu. Ft.	Gallons	Acum. Total Gallons
1203	00	2500	2500	2500	16700	18700
1204	2500	2500	5000	7500	2530036	2336356
1205	2500	2500	5000	10000	8700000	10066400
1206	2500	2500	5000	12500	20575000	31444300
1207	2500	2500	5000	15000	32270500	68722900
1208	2500	2500	5000	17500	51912200	120635300
1209	2500	2500	5000	20000	80000700	200705070
1210	2500	2500	5000	22500	64707025	271831100
1211	2500	2500	5000	25000	100091300	376924300
1212	2500	2500	5000	27500	127000000	603924300
1213	2500	2500	5000	30000	125000000	828924300
1214	2500	2500	5000	32500	125000000	1053924300
1215	2500	2500	5000	35000	125000000	1278924300
1216	2500	2500	5000	37500	125000000	1503924300
1217	2500	2500	5000	40000	125000000	1728924300
1218	2500	2500	5000	42500	125000000	1953924300
1219	2500	2500	5000	45000	125000000	2178924300
1220	2500	2500	5000	47500	125000000	2403924300
1221	2500	2500	5000	50000	125000000	2628924300
1222	2500	2500	5000	52500	125000000	2853924300
1223	2500	2500	5000	55000	125000000	3078924300

OVER

12-00000

# Application of the Law of Conservation of Energy

三、

Robert F. Flecke

February 29, 1980

Mr. J.N. Hunter  
211 Court Street  
Reno, New York 13440

Re: Dam Inspections  
Utica Water Supplies

Dear Mr. Hunter: (15) 350-2455

As requested by you, the following are the results of visual safety inspections of the referred to structures by D.I.C. personnel.

Reservoir #5, D.I.C. #002A  
Hazard Class 2 (Medium)  
No major defects observed.  
Inspection date 11/10/72

Reservoir #7, D.I.C. #002B  
Hazard Class A (Low)  
No major defects observed.  
Inspection date 11/10/72

Beerfield Reservoir #6, D.I.C. #004A  
Hazard Class A  
No major defects observed.  
Inspection date 5/15/73

Graftonburg Reservoir #1, D.I.C. #702  
Hazard Class B  
No major defects observed.  
Inspection date 10/10/71

Black Creek Reservoir (Dry), D.I.C. #006  
Hazard Class B  
No major defects observed.  
Concrete surface deterioration  
Reinforcing steel exposed.  
Inspection Date 9/14/71

DFC

-2-

Harvey Dam - Not inspected.

Reservoir #4, D.E.C. #128C-002

Phase I Report - which you have a copy of.

All of the above dams need periodic maintenance work performed. A yearly program should be initiated so that major problems can be avoided.

Sincerely,

Ramoth D. Farmer  
Dam Safety Coordinator

RMH/ps

cc: Mike Albano  
Paul Robitaille

} American Int'l Co. (INS. CO.)  
100 Summer St.  
Boston, Mass.

# Intra-Company Communication

TO Russell S. DeGallo, Principal Engineer SUBJECT Gray Reservoir  
 FROM Adrian L. Shute, Senior Engineer CARBON TO \_\_\_\_\_  
 DATE June 5, 1981 19\_\_

The following data re:

Gray (Tracy) Reservoir was compiled from existing records of the Consolidated Water Company of Utica and the Utica Board of Water Supply from January 1914 to date.

5 Oct. 1932 - 1.8" rainfall  
 4 Oct. 1932 - over 0.30 spillway  
 5 Oct. 1932 - over 0.60 spillway  
 6 Oct. 1932 - over 0.32 spillway  
 7 Oct. 1932 - over 0.6 spillway  
 8 Oct. 1932 - over 1.0 spillway

1 June 1954 - 2.04" rainfall  
 1 June 1954 - over 0.30 spillway  
 2 June 1954 - over 1.10 spillway  
 3 June 1954 - over 1.30 spillway  
 4 June 1954 - over 1.0 spillway  
 5 June 1954 - over 0.7 spillway

3 May 1951 - over 2.20" spillway

21 March 1949 over 2.0" spillway

NOTE: Precipitation recordings were discontinued January 1975.

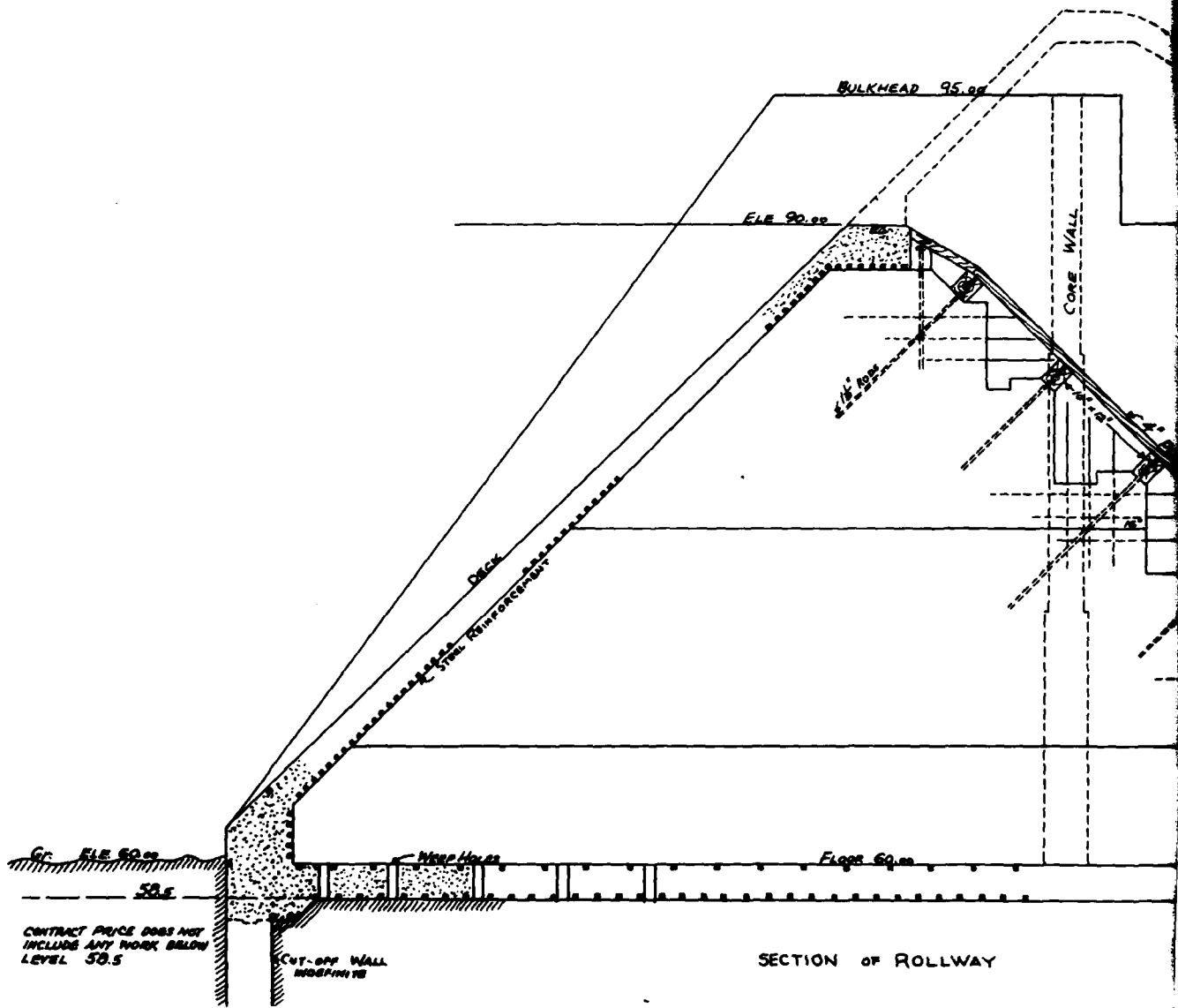
COVER

## APPENDIX G

### DRAWINGS

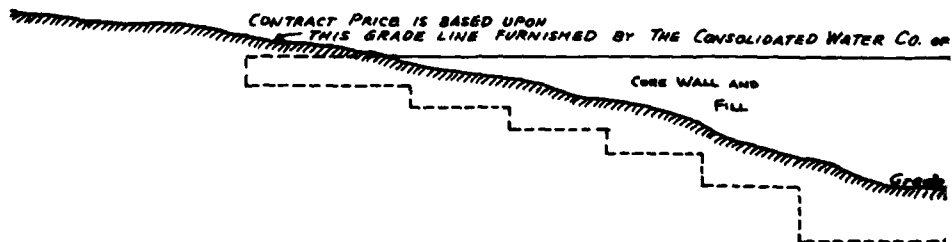
#### TABLE OF CONTENTS

	<u>Page</u>
Line and Elevation - by Ambursen Hydraulic Construction Co. - March 21, 1906.	G-1
Plan of Spillway - by Ambursen Hydraulic Construction Co. - August, 1906.	G-2
Plan Section and Details - tracing by Consolidated Water Co. of Utica of drawing by Ambursen Hydraulic Construction Co. - September 24, 1906.	G-3

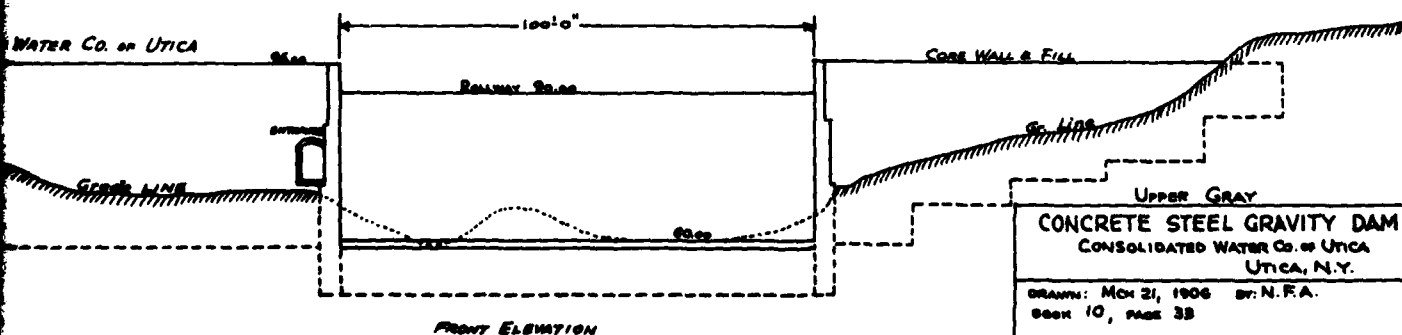
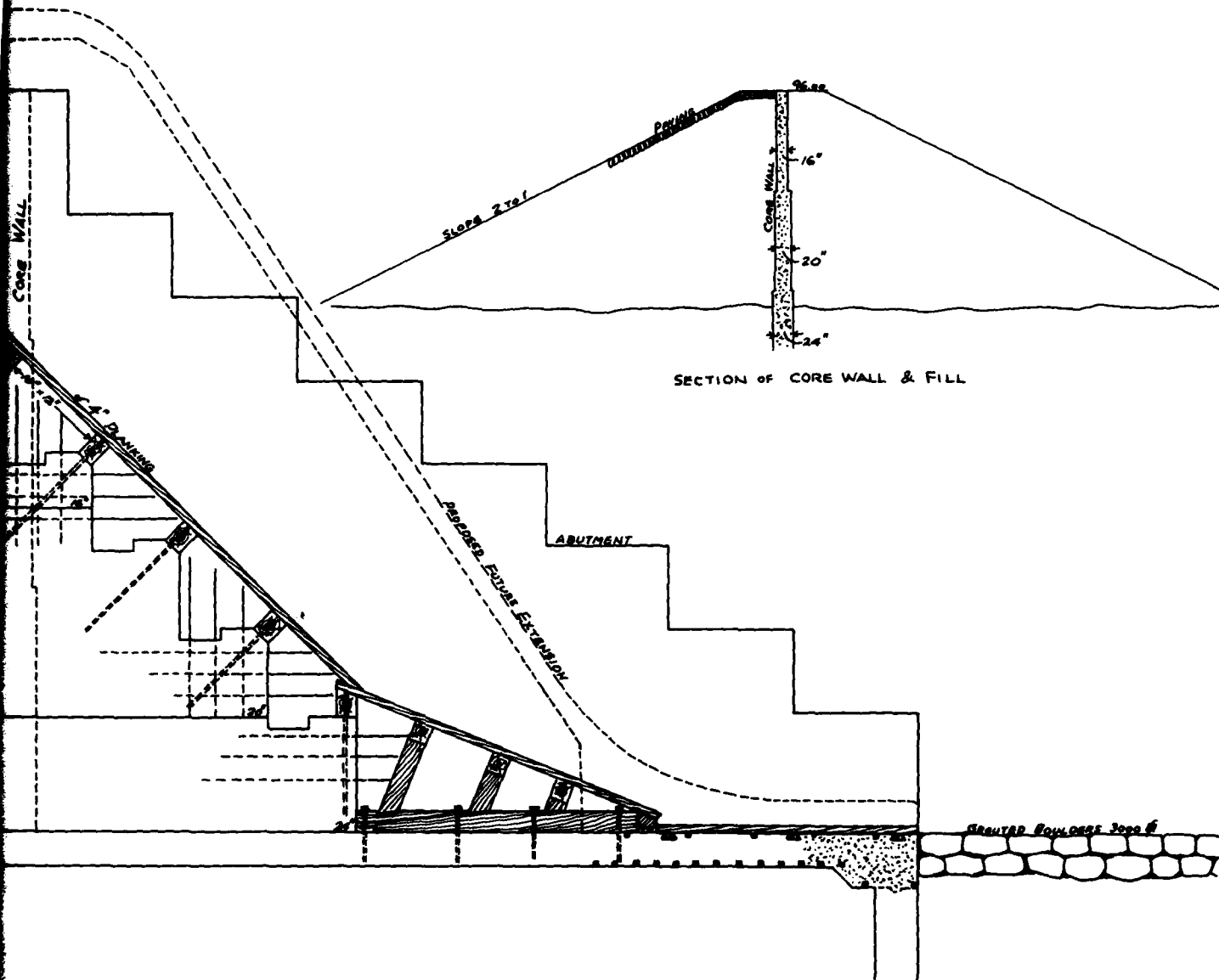


CONTRACT PRICE DOES NOT  
INCLUDE ANY WORK BELOW  
LEVEL 50.5

SECTION OF ROLLWAY



FROM OWNER  
REDUCED TO 56% OF ORIGINAL

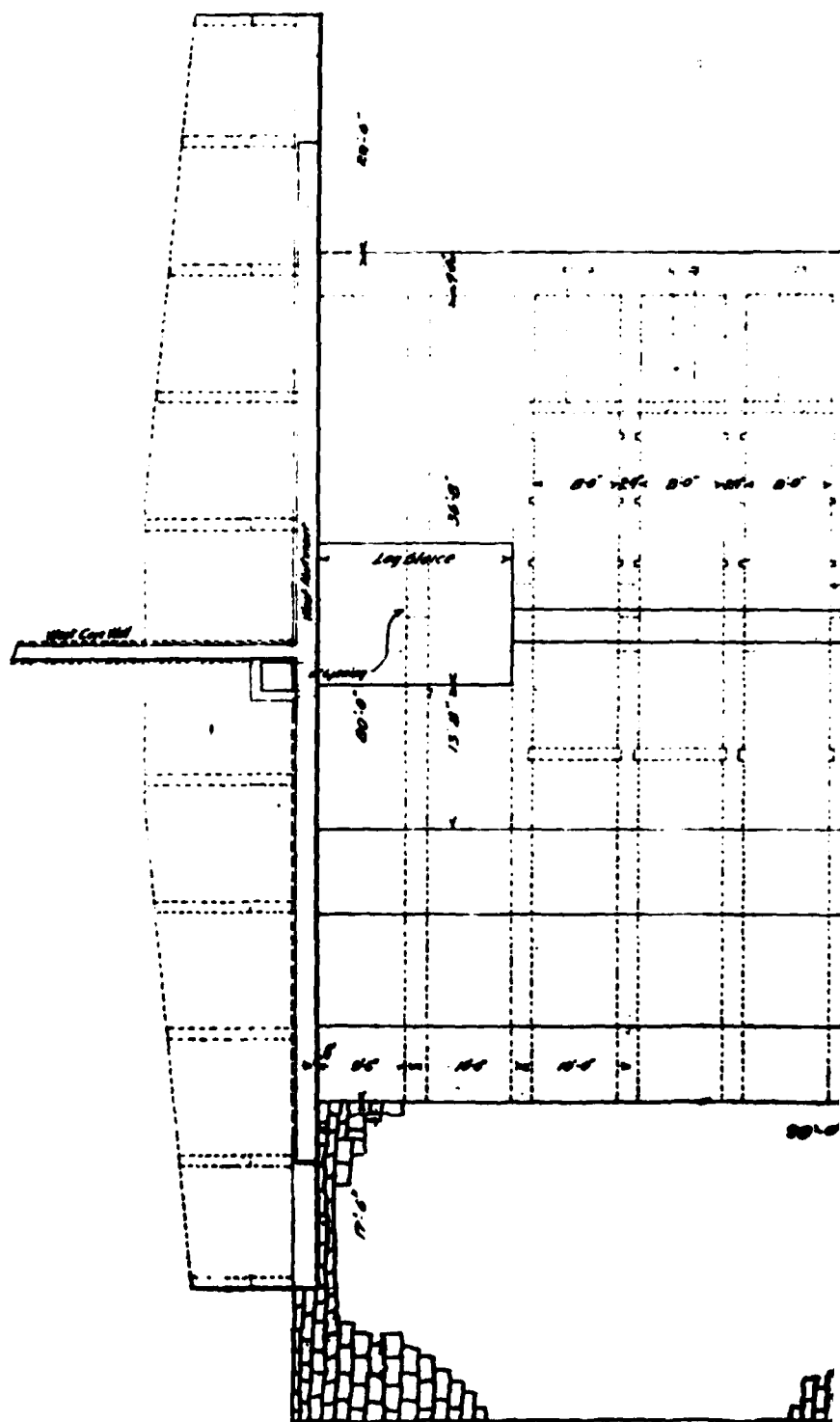


6/16/81 - Traced by C.T. Male Associates, P.C.  
from copy supplied by Utica Board of Water Supply  
CTM Dwg. No. 81-48, Sheet G-1

CONCRETE STEEL GRAVITY DAM CONSOLIDATED WATER CO. OF UTICA UTICA, N.Y.	
DRAWN: MCH 21, 1906 BOOK 10, PAGE 38	BY: N.F.A.
AMBURSEN HYDRAULIC CONSTRUCTION CO. 175 FEDERAL ST., BOSTON, MASS.	
SCALE: 1/8" = 1 FT	<b>6-30</b>

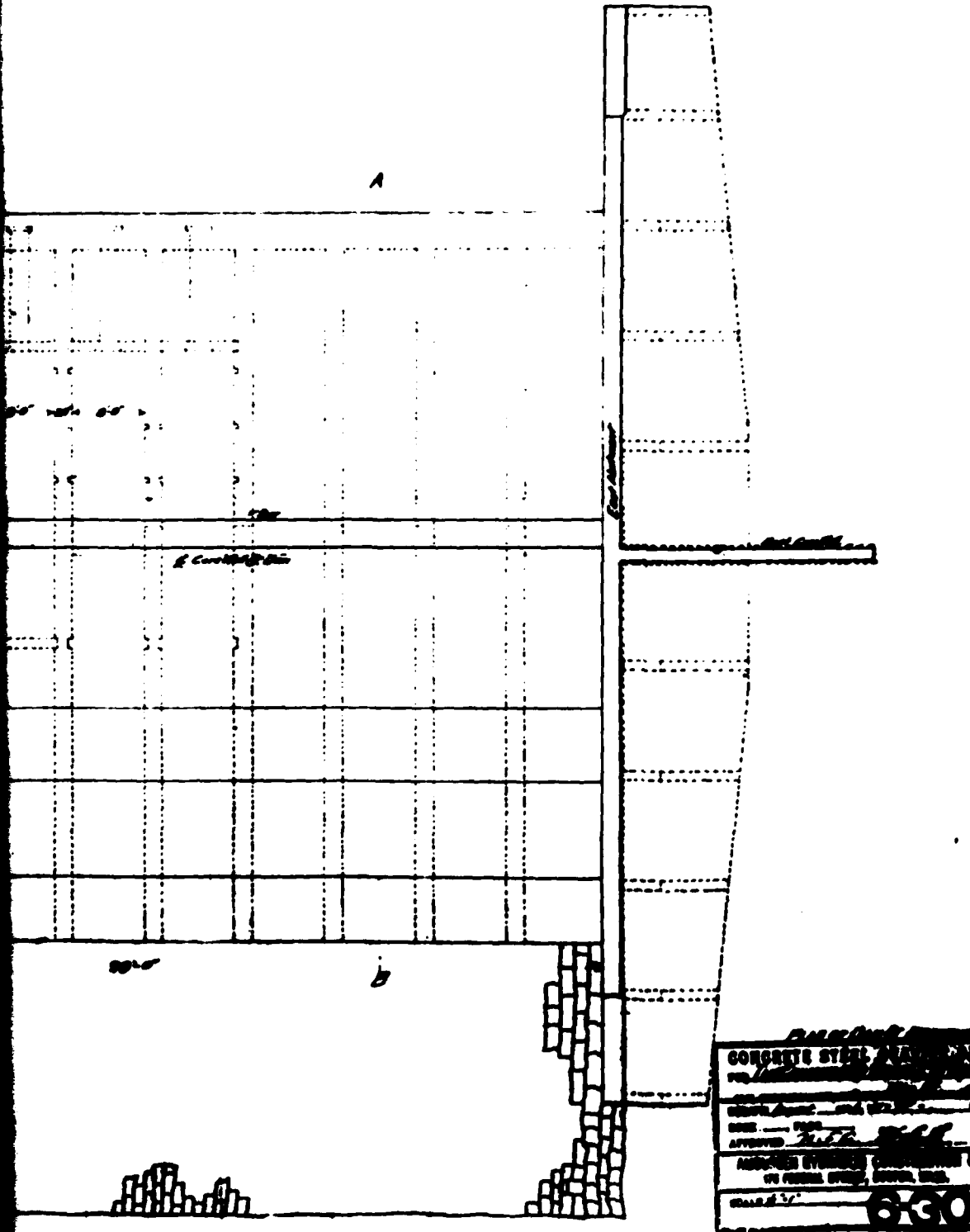
G-1 C.T.M. DWG. NO. 81-48

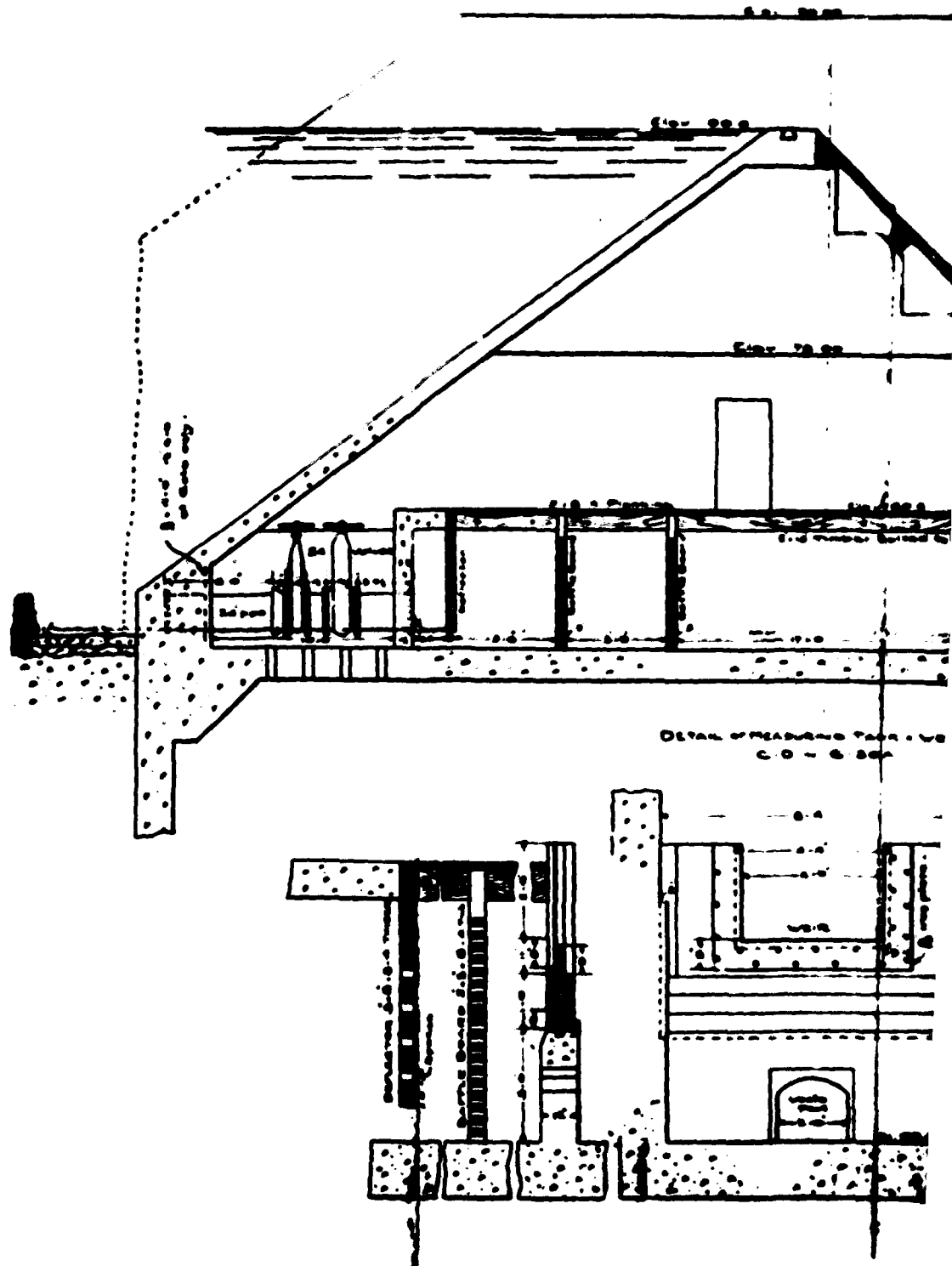
For Section 'A-B' see SWIFT 6-30



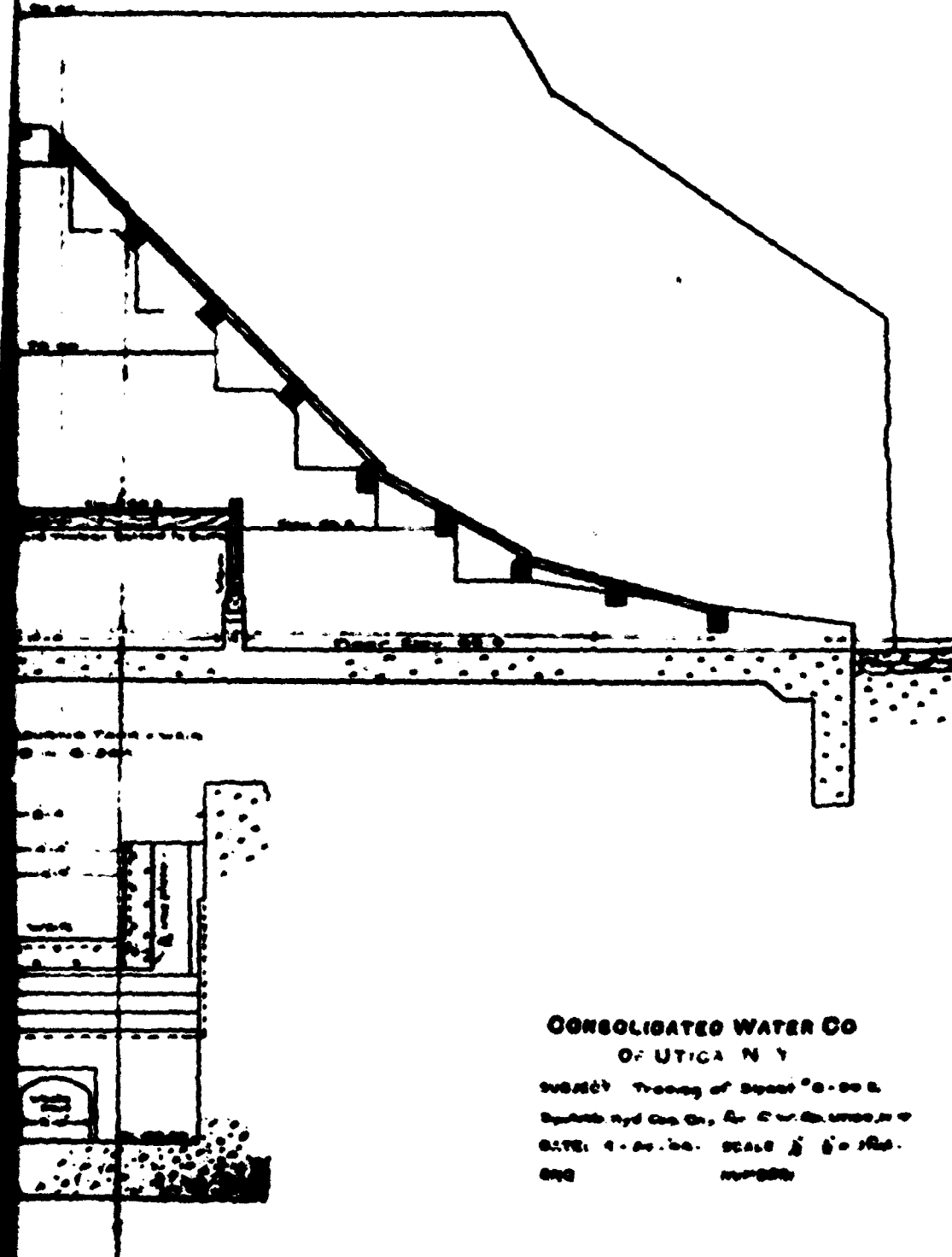
**FROM OWNER  
REDUCED TO 50 % OF ORIGINAL**

SEE SHEET G-30





FROM OWNER  
REDUCED TO 50 % OF ORIGINAL



**CONSOLIDATED WATER CO  
OF UTICA N Y**

SUBJECT: Tracing of Street 10-00-0  
Spartan Hyd. Co. Co., 400 E. W. St. Utica, N. Y.  
DATE: 4-20-00. SCALE: 1/2" = 1'-0"  
ENG: J. J. J. NO. 0000

G-3 CTM DWG NO. 81-48

ATE  
LME

